PEOPLE'S REPUBLIC OF BANGLADESH

ROADS AND HIGHWAYS DEPARTMENT,
ROAD TRANSPORT AND HIGHWAYS DIVISION,
MINISTORY OF ROAD TRASPORT AND BRIDGES (RHD)

PEOPLE'S REPUBLIC OF BANGLADESH

BRIDGE MANAGEMENT CAPACITY DEVELOPMENT PROJECT

PROJECT COMPLETION REPORT

OCTOBER, 2018

JAPAN INTERNATIONAL COOPERATION AGENCY
(J I C A)

JAPAN BRIDGE & STRUCTURE INSTITUTE, INC
ORIENTAL CONSULTANTS GLOBAL CO., LTD.
JAPAN BRIDGE ENGINEERING CENTER.

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Contents

ABBREVIATIONS

Organizations	
GOB	Government of Bangladesh
JICA	Japan International Cooperation Agency
RHD	Roads and Highways Department, Road Transport and Highways Division, Ministry of Road Transport and Bridges
MIS	Management Information System
BMW	Bridge Management Wing
Positions in RHD	
ACE	Additional Chief Engineer
SE	Superintending Engineer
DS	Deputy Secretary
EE	Executive Engineer
SDE	Sub-Divisional Engineer
PD	Provincial Director
TO	Technical Officer
Others	
TAPP	Technical Assistance Project Proforma/Proposal
BMS	Bridge Management System
DAC	Development Assistance Committee
JCC	Joint Coordination Committee
OJT	On-the-Job Training
PDM	Project Design Matrix
R/D	Record of Discussion
M/M	Minutes of Meeting
MT	Master Trainer
WS	Work Shop
EBBIP	East Bangladesh Bridge Improvement Project

MAP of RHD Road Network

PHOTOS

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2015/8/30 1st JCC	2016/1/28 2nd JCC
	
2017/3/5 3rd JCC	2017/12/3 4th JCC
	
2018/8/29 5th JCC	2016/4/16 – 2016/4/29 1st Training in Japan
	
2017/11/5 – 2017/11/18 2nd Training in Japan	2018/10/1 Equipment Handover and Closing Ceremony

I. Basic Information of the Project

1. Country

People's Republic of Bangladesh

2. Title of the Project

Bridge Management Capacity Development Project

3. Duration of the Project (Planned and Actual)

➢ Project Implementation Period

Planned : July 10th 2015 –January 2nd 2018 (30 months)

Revised : July 10th 2015 – September 2nd 2018 (38 months)

➢ Consultant Contract Period

Planned : July 10th 2015 – March 2nd 2018 (32 months)

Revised : July 10th 2015 – November 2nd 2018 (40 months)

➢ GOB : As per revised TAPP, September 1st 2015 – December 31st 2018

4. Background (from the Record of Discussions (R/D)

Bangladesh has experienced a firm economic growth in recent years maintaining the annual GDP growth rate of about 6 percent. Along with that, freight volume has increased by approximately 8 times in the 30 years between 1975 and 2005, and the freight volume and the number of passengers has maintained an upward trend at a pace of 6-7 percent. Among the major means of transportation in Bangladesh such as inland waterway, railway and road, the rate relying on road use in both passenger and freight has exceeded 80 percent in 2005. However, new road construction is not adequately implemented against an increase of the traffic volume, and condition of existing road is deteriorating due to incompetent capacity on roads/bridges maintenance and budgetary deficit. These obstacles are hindering smooth transportation of passenger and freight.

According to the "Sixth Five Year Plan (2011-2015)", GOB defines that efficient and modern road transportation system plays an important role in the road sector for achieving "Sixth Five Year Plan" and "Vision 2021" which is the mid-term aim of Bangladesh. Furthermore, appropriate maintenance on existing roads is placed as an important issue in order to reduce costs for road users. "National Land Transport Policy (2004)" describes that enhancing maintenance capacity, securing budgets and formulating a long-term development plan are prioritized as an important policy. "Road Master Plan (2009)" formulated based on "National Land Transport Policy" mentions that maintaining asset value of roads and bridges is one of the aims to be focused.

Construction of bridges in Bangladesh has been accelerated drastically after its independence in

1971, and the number of bridges and culverts increased from 1,112 to 18,356 in 2013. Meanwhile, the rapid increase of bridges has caused frequent falls of bailey bridges (emergency bridges) and road condition has seriously deteriorated due to inadequate maintenance. Though GOB is aware of the necessity of the capacity development on bridge management, it is yet to be implemented. This results in bridges fall before the arrival of the end of their durable years.

Under the above background, GOB requested GOJ to implement "Technical Cooperation for Bridge Maintenance and Management System under Roads and Highways Department" with aiming to introduce preventive bridge maintenance utilizing the bridge management system. In response to this request, JICA conducted a detailed planning survey in June 2014 so as to confirm the details of the request, to study the project description and to discuss with GOB, and Record of Discussion was signed by both JICA and GOB in February 2015.

"Japan Country Analytical Work" (April 2013) regards the development of whole-country traffic network as an important issue and "Japan's Country Assistance Program for Bangladesh (June 2012)" stipulates that traffic infrastructure should be developed in order to promote the movement of person and freight. The Project fully complies with the above country analytical work and country assistance program.

5. Overall Goal and Project Purpose (PDM Version 6)

- Overall Goal:

  Bridge management under RHD is enhanced.

- Project Purpose

  Bridge maintenance capacity of RHD is improved.

6. Implementing Agency

Roads and Highways Department, Road Transport and Highways Division, Ministry of Road Transport and Bridges (RHD)

7. Outline of the Project

7-1. Basic Information

7-1-1. RHD Road Network

The road network in Bangladesh is composed of National Highways, Regional Highways, Zila Roads, Upazila Roads, Union Roads and Village Roads. Among them, National Highways, Regional Highways and Zila Roads are under RHD jurisdiction. Other roads are under the jurisdiction of LGED (Local Government Engineering Department), Ministry of Local Government, Rural Development & Cooperative.

Table 1-1 shows the details of roads in Bangladesh compared to roads in Japan.

Table 1-1 Comparison of Roads in Bangladesh with Roads in Japan

Road Classification		Actual Length (km)		Pavement Ratio (%)		Road Density (km/1000km2)	
Bangladesh	Japan	Bangladesh	Japan	Bangladesh	Japan	Bangladesh	Japan
Expressway	Expressway	—	7,431.20	—	100	—	20
National Highway	National Highway (Specified Section)	3,812.78	22,591.60	92.8	100	26	60
Regional Highway	Nationa Highway (Non-specified Section *)	4,246.97	31,938.80		98.9	29	85
Zila Road	Provincial Road	13,242.33	129,328.90		96.3	90	342
Upazila, Union and Village (UUV) Road	City, Town and Village (CTV) Road	304,379.31	1,009,599.40	27.4	76.2	2,067	2,671
TOTAL		325,681.39	1,200,889.90	31.7	79.6	2,207	3,178

* Not administrated by Ministry of Land Infrastructure ar Source: Japan: Annual Road Statistics in Japan, 2008
Trasport, but by Provincial Government Bangladesh: RHD Home Page, LGED Home Paga 2015

NB) Pavement ratio of Bangladesh includes low cost pavement (blacktop).

7-1-2. Condition of Bridges and Culverts

Table 1-2 shows bridge condition category classified by bridge type. The data in this table is classified based on old manual (Bridge Condition Survey Manual, 2004). The data regarding Box Culvert, Slab Culvert and Arch Masonry are inspection results in 2004 and the data regarding other bridges are inspection results conducted by EBBIP in 2013. Therefore, the classification of this table is not based on the outputs of this project.

According to Table 1-2, the ratio of category D is high in Arch Masonry, RC Girder and Steel Girder excluding the ratio of Truss (TD) and Bailey (TD) of which numbers are extremely small. On the other hand, Box Culvert and PC Girder are far much sound compared to other bridge types. The ratio of category D in Bailey (SD) is lower than the one imagined although they are not permanent bridges.

Bridge condition categories A, B, C, D are as follows according to old manual.

Condition Category A : No damage
Condition Category B : Minor damage
Condition Category C : Major elemental damage
Condition Category D : Major elemental damage

Table 1-2 Bridge Condition Category by Bridge Type
according to the Classification of Old Manual

	A		B		C		D		Sub-total
	Nos.	Rate(%)	Nos.	Rate(%)	Nos.	Rate(%)	Nos.	Rate(%)	
Box Culvert	7554	79.6	1016	10.7	794	8.4	131	1.4	9495
Slab Culvert	2554	63.7	494	12.3	755	18.8	207	5.2	4010
Arch Masonry	149	44.7	61	18.3	87	26.1	36	10.8	333
Sub-total	10257	74.1	1571	11.4	1636	11.8	374	2.7	13838
RC Slab	127	51.8	34	13.9	68	27.8	16	6.5	245
RC Girder	904	37.8	500	20.9	725	30.3	264	11.0	2393
PC Girder	282	69.5	61	15.0	52	12.8	11	2.7	406
PC Box	2	40.0	0	0	3	60.0	0	0	5
Sub-total	1315	43.1	595	19.5	848	27.8	291	9.5	3049
Steel Girder	76	33.0	35	15.2	89	38.7	30	13.0	230
Truss (SD)	152	74.1	13	6.3	32	15.6	8	3.9	205
Truss (RCD)	17	56.7	4	13.3	8	26.7	1	3.3	30
Truss (TD)	3	50.0	0	0	2	33.3	1	16.7	6
Sub-total	248	52.7	52	11.0	131	27.8	40	8.5	471
Baily (SD)	570	58.5	132	13.6	213	21.9	59	6.1	974
Baily (TD)	11	47.8	2	8.7	6	26.1	4	17.4	23
Sub-total	581	58.3	134	13.4	219	22.0	63	6.3	997
Grand-total	12401	67.6	2352	12.8	2834	15.4	768	4.2	18355

NB: (SD)=(Steel Deck), (RCD)=(RC Deck), (TD)=(Timber Deck)
Source: Box Culvert, Slab Culvert, Arch Masonry=BMMS
Other Types of Bridges=EBBIP Survey Results

7-1-3. Transition of Road and Bridge Maintenance Budget

Table 1-3 shows the transition of road and bridge maintenance budget. The fiscal year of Bangladesh is from July until June of next year.

Table 1-3 Transition of Road and Bridge Maintenance Budget

(Unit: Million Taka)

Budget Item	Fiscal Year					
	2012	2013	2014	2015	2016	2017
Routine Maintenance	530	530	750	800	950	1,000
PMP Minor (Road & Bridge)	4,656	3,064	2,996	4,307	3,285	3,739
PMP Major (Road)	5,500	7,680	8.103	8,080	8,850	10,600
PMP Major (Bridge)	500	1,000	1,200	1,350	1,600	1,500
Emergency Maintenance (Road & Bridge)	170	100	100	100	100	100
Total	11,356	12,374	13,149	14,637	14,785	16,939

PMP Major (Bridge) became double in 2013 compared to the amount of previous year. Since then, PMP Major (Bridge) has an increasing tendency. However, allotted amount itself is not enough compared to requested amount. Budget allocation is determined by Ministry of Finance considering the performance of previous year, requested amount, national policy and so on.

7-1-4. Organization of RHD

Figure 1-1 shows the organization of RHD. Headquarter of RHD is located in Dhaka and is composed of 5 Wings. In regions, 10 local organizations called Zone exist. Under Wings or Zones, Circles, Divisions and Sub-Divisions are arranged hierarchically. Heads of each organization are Chief Engineer (CE) for whole RHD, Additional Chief Engineer (ACE) for Wing or Zone, Superintending Engineer (SE) for Circle, Executive Engineer (EE) for Division and Sub-Divisional Engineer (SDE) for Sub-Division respectively. Under 10 Zones, 21 Circles, 65 Division and 161 Sub-Divisions including Workshop Sub-Divisions. Besides this, specialized project offices exist. These project offices are headed by ACE or SE.

ORGANOGRAM OF ROADS AND HIGHWAYS DEPARTMENT

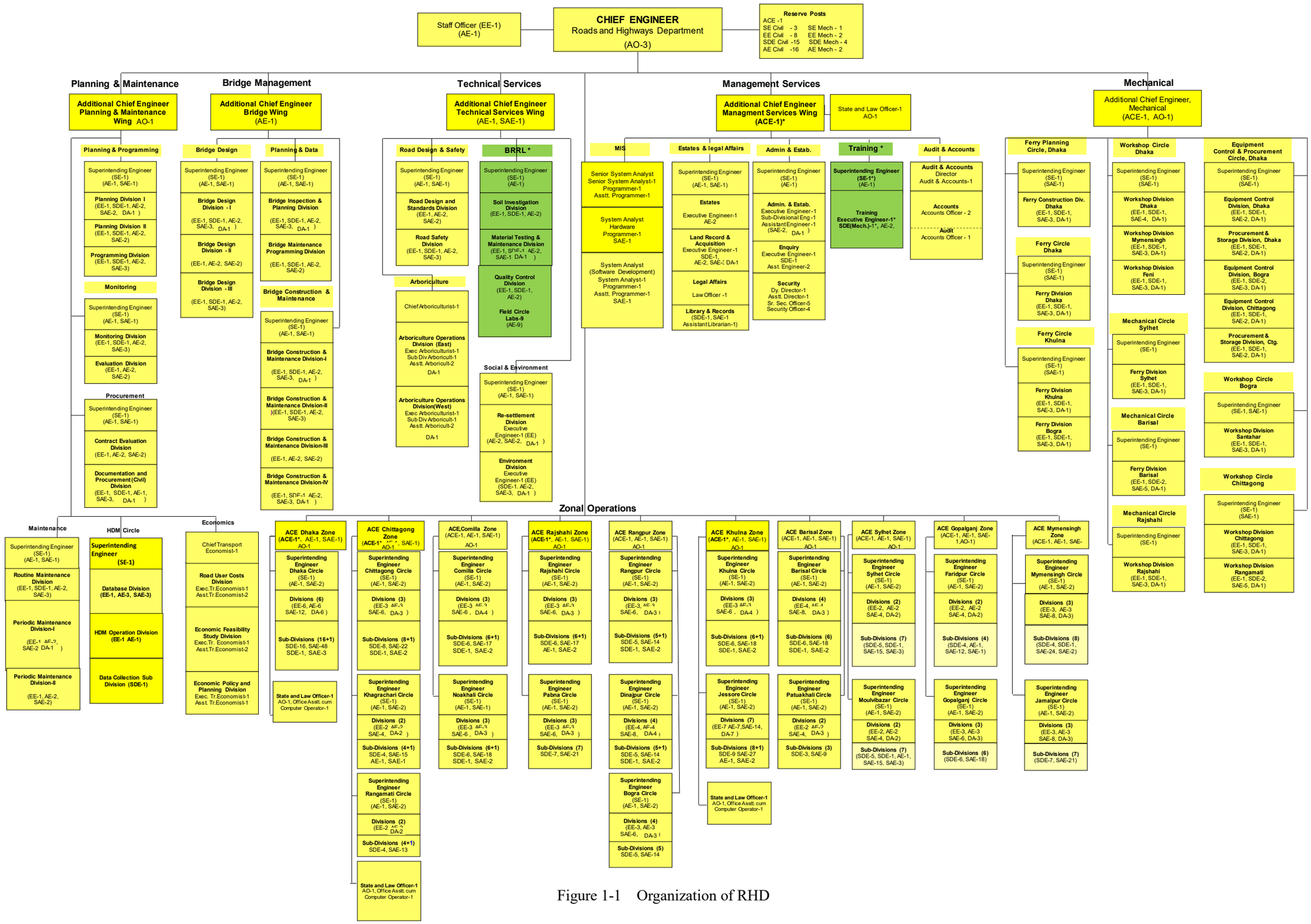


Figure 1-1 Organization of RHD

7-1-5. Staff Deployment of RHD

Table 1-4 shows the staff deployment of RHD.

There exist 9,377 posts but the number of personnel who is actually deployed is only 26 % of the number of posts. Especially the number of Class III and Class IV personnel who are in charge of bridge maintenance works at the site is extremely small. As its reason, it seems that the number of personnel doesn't reach the fixed number due to lack of budget. In order of resolve this issue, the clarification and continuous security of required budget are needed.

The description of Class I to Class IV is as follows.

- Class I : Academic Career 16 years University equivalent
- Class II : Academic Career 13 years Junior College level
- Class III : Academic Career 10 years High School level
- Class IV : Academic Career 8 years Junior High School level

Table 1-4 Staff Deployment of RHD

Post Name	Number of Posts	Number of Staff	Remarks
Chief Engineer	1	1	
Additional Chief Engineer (Civil)	14	14	
Additional Chief Engineer (Reserved) (Civil)	1	0	
Superintending Engineer Director (SE) (Civil)	35	35	
Superintending Engineer Director (Reserved) (Civil)	3	1	
Executive Engineer (Civil)	99	99	
Executive Engineer (Reserved) (Civil)	8	8	
Sub-Divisional Engineer (Civil)	153	130	
Sub-Divisional Engineer (Reserved) (civil)	15	0	
Assistant Engineer (Civil)	174	137	
Assistant Engineer (Reserved) (Civil)	16	0	
Class Ⅰ Civil Engineers	519	425	Subtotal A
Class Ⅰ Mechanical Engineers	97	55	B
Other Class Ⅰ Specialists	33	16	C
Total Class Ⅰ Posts	649	496	D=A+B+C
Total Class Ⅱ Posts	883	768	E
Total Class Ⅲ Posts	4,540	842	F
Total Class Ⅳ Posts	3,305	344	G
Total	9,377	2,450	Total D+E+F+G

7-2. Contents of the Project

7-2-1. Flow of the Project

The flow of the Project is illustrated in Figure 1-2.

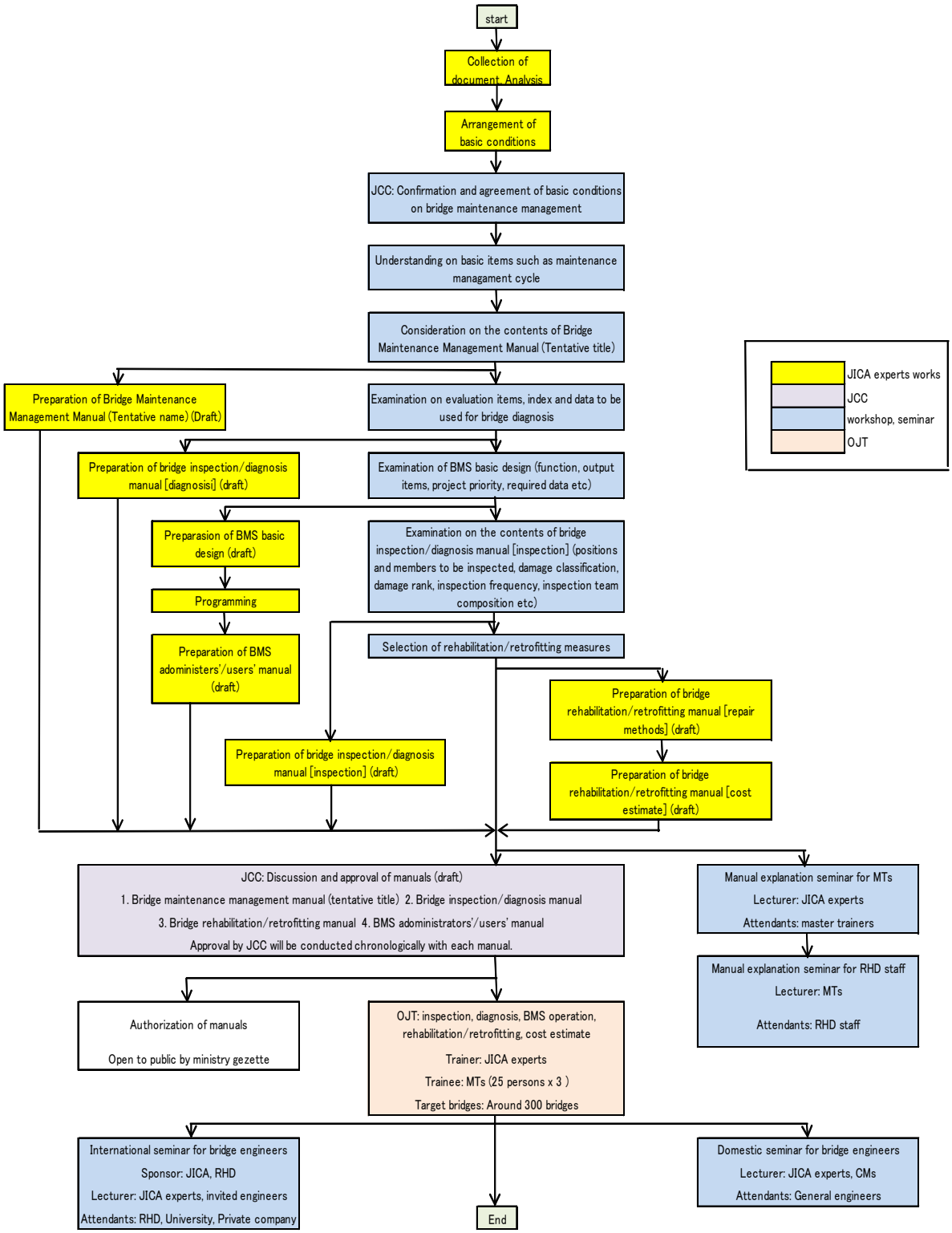


Figure 1-2 Flow of the Project

Basic flow of the Project is as follows.

a) Collection of basic information related to bridge maintenance management of RHD at the time of first stay in Bangladesh

Data collection through hearing with RHD staff at Headquarter and divisional offices, site visits for the purpose of grasping the actual state of bridge maintenance of RHD and selecting model area(s) and the submission of questionnaire to know more detailed information.

Model area(s) is selected considering the following items.

1. Considering the influence to the routine works of OJT attendants, the division office or sub-division office which manages proper number of bridges will be selected.
2. Division office which manages the area where road blockade, hartal (general strike) or such political turmoil frequently takes place should be avoided.
3. Division office which manages the area where traveling is restricted due to chronic traffic congestion should be avoided.

As the result, Manikganj Division was appointed as model area in 1st JCC.

Figure 1-3 Map of Manilganj model area

b) Analysis and arrangement of collected data and information sharing with RHD at WS

Workshops related to "Bridge Maintenance Management Standard" which is handling common items precede and the necessity and significance of bridge maintenance based on maintenance cycle are recognized.

c) Execution of WS regarding Bridge Inspection / Evaluation Manual, Bridge Rehabilitation / Strengthening Manual and BMS

These WSs proceed simultaneously. All manuals are approved by JCC.

d) Manuals are used as the textbooks of OJT and through OJT, 75 Master Trainers are trained.

e) Master Trainers train general staff of RHD as trainers by using Manuals.

f) General staff trained by MTs conduct nation-wide bridge inspection as inspectors.

7-2-2. Flow of BMS Development

In September 2015, JICA project team interviewed with BMMS Division in Bridge Management Wing and MIS in Management Service Wing about the existing BMMS and we proposed the new functions to be added to existing BMMS. BMMS Division and MIS commented about the existing BMMS as follows,

a) They do not have materials of existing BMMS (such as Original manual / Design specification / Source code and original data of first BMMS.)
b) They considered that it is impossible to update existing BMMS to new BMS due to lack of materials described above, a).
c) Existing BMMS doesn't have enough functions as system based on new manuals in this project.
New program should be constructed instead of the upgrade of existing BMMS. As the result of the interview, JICA project team decided to develop BMS as "New program"

In examination of new BMS, Bangladesh side required to make the system as full scratch building with computer language. JICA project team considered the idea and judged making BMS as full scratch building. The flow of the BMS operation is illustrated in Figure 1-4.

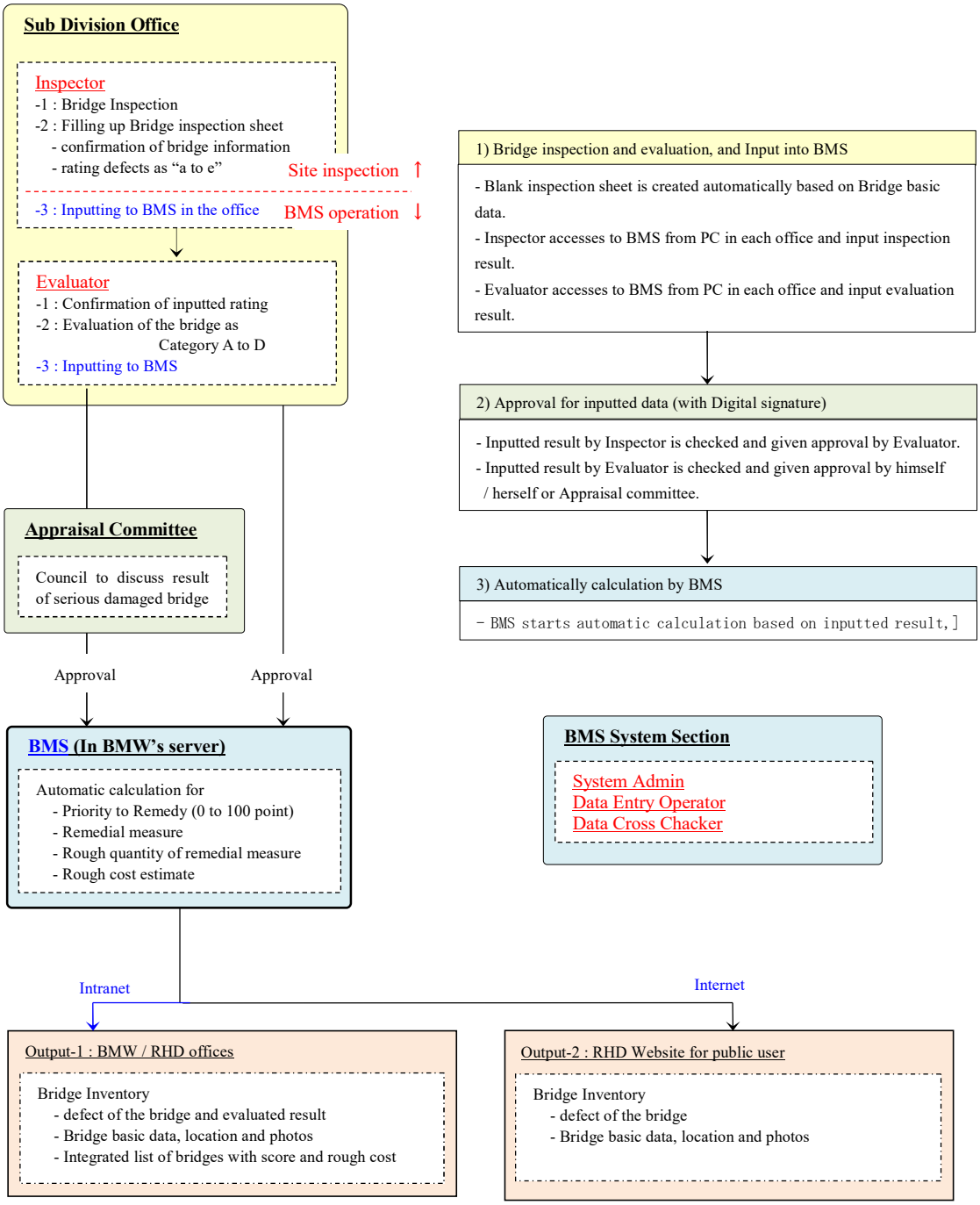


Figure 1-4 Flow of the BMS Management

7-2-3. Outputs of the Project and Activity Policies for Outputs

The Project is expecting the following four outputs. Tables 1-5 to Table 1-8 show the fundamental policies of activities for four outputs.

Table 1-5 Activity Policy for Output 1

Output 1: Bridge Maintenance framework is developed.	
Activity 1-1: Actual condition of bridge maintenance is reviewed.	Activity policy : A hearing about the present situation of bridge maintenance works and the system of RHD are performed. Also, various standards and the reports/documents about bridge maintenance works are collected and arranged.
Activity 1-2: Problems/issues on bridge maintenance cycle are identified.	Activity policy : By explaining the concept of bridge maintenance cycle to CM, the importance of work implementation according to bridge maintenance management cycle is recognized. In addition, based on the real state of bridge maintenance management works which was grasped through (Activity 1-1), the issues on the introduction and settlement of bridge maintenance management cycle are selected and arranged and the solutions on the issues in each stage bridge maintenance management cycle are discussed and examined at WS. Furthermore, from the viewpoint of preventive maintenance, the contents of routine maintenance works are to be discussed and arranged.
Activity 1-3: Institutional framework of bridge maintenance is reviewed.	Activity policy : In order to do the maintenance works accordng to bridge maintenance management cycle effectively and continuously, organizational improvement is to be discussed and examined at WS.
Activity 1-4: Documents of bridge maintenance procedure and standard of staff deployment is prepared.	Activity policy : Based on (Activity 1-1) to (Activity 1-3), such items as current situation of bridge maintenance works, institutional improvement, organizational system, composition of manuals, syatems, equipment which are required to introduce and settle the concept of bridge maintenance management cycle are systematically arranged and " Bridge Maintenance Management Work Manual (tentative name) " (draft) is established.

Table 1-6 Activity Policy for Output 2

Output 2: Bridge inspection / evaluation manual and Bridge rehabilitation / strengthening manual are developed.	
Activity 2-1 : Existing bridge maintenance manual is reviewed and issues / problems on the manual are analysed.	Activity policy : Existing bridge maintenance manuals and technical standards / guidelines are reviewed and the issues / problems are are extracted and analysed.
Activity 2-2 : Bridge inspection / evaluation manual is updated.	Activity policy : Bridge inspection / evaluation manual consists of two parts, namely Pant I : inspection and Part II : Evaluation. Part I includes the detailed investigations concerning carbonization depth of concrete, penetration depth of salt into concrete and cracks on steel structures. Part II is developed considering elements of bridges, location of defects, types of defects, causes of defects, progress of defects, urgency of repairs, and comprehensive evaluation method of defects.
Activity 2-3 : Bridge rehabilitation / strengthening manual is prepared.	Activity policy : Bridge rehabilitation and strengthening manual consists of two parts, namely Part I : Method and Part II : Cost Estimate. Bridge rehabilitation and strengthening metods are selected from among the latest techniques and are decided under the agreement of CM though the discussions at WS considering the possibility and the easiness of procurement of materials, equipment required for the methods in Bangladesh market. Rehabilitation and strengthening methods developed in Japan are recommended. In Part II, tables of unit prices for selected rehabilitation and strengthening methods are presented considering composition of labors, quantity of materials, kinds of equipment, temporary structures and so on.
Activity 2-4 : Manuals for Bridge maintenance are explained to RHD staff by Master Trainers (MT).	Activity policy : Master trainers explain Bridge Maintenance Manuals to other RHD staff in order to spread the understanding of the manuals to all RHD staff.

Table 1-7 Activity Policy for Output 3

Output 3 : Bridge management system is developed.	
Activity 3-1 : Existing BMMS is reviewed and analysed.	Activity policy : The function, operationability, recorded data, output data, way of utilization and so on of existing BMMS are reviewed from the viewpoint of the system developers and users.
Activity 3-2 : Utilization of BMS is examined together by RHD.	Activity policy : Based on the results of analysis conducted through (Activity 3-1), the utilization of BMS is discussed and examined at WS. Furthermore, in order to utilize BMS continuously as a truly necessary system, the understanding for the positioning of BMS in bridge maintenance management cycle and the usage of BMS which is suitable for RHD is to be examined.
Activity 3-3 : Function of BMS is defined and developed.	Activity policy : Based on the usage of BMS examined through (Activity 3-2), the basic design of BMS is to be conducted. Bridge maintenance management expert will conduct the basic design of BMS together with a Bangladesh system engineer.
Activity 3-4 : Data in existing BMMS is entered into BMS by RHD.	Activity policy : Entering data of existing BMMS into BMS is to be examined carefully as the data of BMMS does not always coincide with the inspection items of bridge inspection / evaluation manual and the data of 2004 yeay inspection and the data of 2013 year inspection are mixed in existing BMMS and so on. It is to be requested to RHD that the inspection of all bridges / culverts is conducted as early as possible and those inspection data are input into BMS. This early implementation of bridge inspection is to be requested and confirmed at the first JCC.
Activity 3-5 : BMS manual for administrators and users is prepared.	Activity policy : Users' manual which is simple and understandable for general bridge engineer is prepared. Administrators' manual which is used when system engineers maintain BMS is prepared.
Activity 3-6 : BMS manual is explained to RHD staff by BMS administrators.	Activity policy : Administrators of BMS explain the operation and usage of BMS to RHD staff who utilize BMS. Considering the security of data, RHD staff whom administrators explain the manual is to be selected after due discussion and confirmation.

Table 1-8 Activity Policy for Output 4

Output 4 : Necessary knowledge of bridge management is enhanced by RHD staff.	
Activity 4-1 : On the job training (OJTs) on bridge inspection / evaluation in model area(s) are conducted with Bridge inspection / evaluation manual.	Activity policy : The ability of RHD on bridge inspection / evaluation is enhanced by conducting bridge inspection / evaluation actually through OJTs in model area with developed bridge inspection / evaluation manual.
Activity 4-2 : OJTs on prioritizing bridges to be repaired in model area(s) are conducted by utilization of BMS.	Activity policy : Based on the results of bridge inspection / evaluation, the bridges to be repaired are selected and the priority of the bridges to be repaired is calculated with BMS through OJTs.
Activity 4-3 : OJTs on selection of bridge rehabilitation / strengthening measures, cost estimation in model area(s) are conducted with Bridge rehabilitation / strengthening manual.	Activity policy : The selection of rehabilitation / strengthening measures on the target bridges selected through (Activity 4-2), rough estimation of cost and establishment of repair plan are carried out through OJTs to develop the ability on bridge rehabilitation / strengthening.
Activity 4-4 : Advices on supervision of bridge rehabilitation / strengthening works are given by Expert.	Activity policy : The items concerning the way of examination on the execution plan of repair works, quality control, tests, process control, work safety control, traffic safety control and environmental management are guided and advised by Experts.
Activity 4-5 : Institutional capacity development plan is prepared.	Activity policy : Institutional development plan consists of two parts, namely Part I : Development plan on procedures and staff deployment and Part II : Human resouces development plan. Part I is detailed and concrete plan concerning procedures and staff deployment. Part II is established to enhance human resources who manage bridge maintenance works effectively and continuously according to bridge maintenance cycle.

II. Results of the Project

1. Input and Activity of the Project

1-1. Input by the Japanese side (Planned and Actual)

Planned and actual inputs by the Japanese side are shown in Table 2-1.

(1) Regarding the experts, it was difficult to dispatch the experts as per original schedule due to the security issues which occurred on July 1st of 2016. Some experts couldn't come to Dhaka because of the large gap of time between planned and actual dispatch.. Furthermore, due to some constraints like limitation of stay period, restriction of numbers of persons who are allowed to stay in Dhaka during same period, escort by police outside Dhaka, the dispatch period often had to be changed. However, without the addition of new experts, the problems were coped with by some experts taking charge of multiple works/roles.

The addition of bridge management system (2) expert is done because a specialized system manager was required due to the policy change which changed BMS from being developed using commercially available program to a full-scratched sophisticated program..

The deletion of asset management expert is because of cancellation of the international seminar due to security concerns.

(2) Regarding the procurement of equipment, ground penetrating radar was changed to more practical re-bar detector. This is because detailed survey expert judged that easier to use re-bar detector is enough for the purpose of re-bar detection. Furthermore, two sets of robot cameras were added. Although a bridge inspection vehicle was requested by RHD, robot cameras were chosen because under bridge can be inspected without the disturbance of traffic flow and the cost is cheaper compared to bridge inspection vehicles. Table 2-2(1) to Table 2-2(4) shows the list of equipment.

(3) Regarding the training in Japan, considering the extension of project period, the third training in Japan was planned but it was cancelled because the selection of training period was not appropriate.

(4) Project period was extended 8 months as the experts couldn't enter Bangladesh for 6 months due to security problems.

(5) The project cost increased. The difference between original contract and the fourth revision is shown in Table 2-3. The increase of travel expense is because the number of traveling abroad increased followed by the restriction of stay period. The increase of general business expenses is because the employment costs of local staff increased followed by the extension of project period. The increase of direct labor costs is because of re-arrangement of activity period at site, the addition of BMS system manager, the addition of training for general RHD staff and so forth. The increase of general management expenses includes the increase of miscellaneous expenses followed by security problems.

Table 2-1 Input – Japanese Side

Inputs	Plan (PDM ver. 1)	Actual (PDM ver. 6)
(1) Experts	1. Team Leader/Bridge Maintenance Plan 2. Bridge Inspection 3. Bridge Evaluation 4. Bridge Maintenance Plan (2) 5. Detailed Survey 6. Bridge Rehabilitation・Strengthening/Bridge Evaluation (2) 7. Cost Estimate 8. Bridge Management System 9. Asset Management 10. Project Monitoring 11.Coordinator/Bridge Maintenance Plan (Assistance)	1. Team Leader/Bridge Maintenance Plan 2. Bridge Inspection 3. Bridge Evaluation 4. Bridge Maintenance Plan (2) 5. Detailed Survey 6. Bridge Rehabilitation・Strengthening/Bridge Evaluation (2) 7. Cost Estimate 8. Bridge Management System 9. Bridge Management System (2) 10. Project Monitoring 11. Project Monitoring (2) 12.Coordinator/Bridge Maintenance Plan (Assistance)
(2) Equipment	1 Computers for database with accessories 2 Concrete testing equipment ・Ground penetrating radar (RC Rader) ・Concrete core sampling apparatus ・Electric drill	1 Computers for database with accessories 2 Concrete testing equipment ・Re-bar detector ・Concrete core sampling apparatus ・Electric drill ・Robot camera
(3) Training in Japan	Training in Japan: 2 times (once/ year)	Training in Japan: ● The 1st training in Japan was conducted from 16th to 29th April 2016. 8 participants who played center roles in the Project participated in the training. ● The 2nd training in Japan was conducted from 5th to 18th November 2017. 8 participants who played center roles in the Project participated in the training. ● The 3rd training in Japan was planned. However, because of some reasons, The training plan was cancelled.
(4) Project implementation period	July 10th, 2015 – January 2nd, 2018	July 10th, 2015 – September 2nd, 2018 (Extending for 8 months)
Consultant contact period	July 10th 2015 – March 2nd, 2018	July 10th, 2015 – November 2nd, 2018 (Extending for 8 months)
(5) Project Cost	250,385,040 JPY	338,286,240 JPY

Table 2-2 (1) List of Equipment provided by JICA

No.	Name	Specification	Pieces	Purpose of Use	Photos
1	Re-bar detector	HILTI PX10 (electromagnetic induction method)	2	Covering depth, Re-bar position	
2	Concrete core cutter	core size =100 mm maximum depth = 100 mm	2	Chloride ion concentration, ASR test	
3	Concrete drill	core diameter = 22 mm	2	Carbonization, Salt content	
4	Robot Camera		2	Defect observation by camera	
5	Laptop		11	Recording	

Table 2-2 (2) List of Equipment for Inspection

No.	Name	Specification	Pieces	Purpose of Use	Photos
1	Binocular	Prism Type : Roof Objective Lens : 25mm Maginification : 10	6	Inspection	
2	Inspection hammer	Appellation : #1/2 Length : 420mm Head Diameter : ϕ17 Head Length : 113mm Head Weight : 200g	6	Inspection	
3	Inspection hammer (Long)	Appellation : #1/2×900 Length : 900mm Head Diameter : ϕ17 Head Length : 113mm Head Weight : 200g	6	Inspection	
4	Clack Gauge		1000	Inspection	
5	GPS		6	Inspection	
6	Leser Range Finder	Maximum Measurement Distance : 250m	6	Inspection	
7	Reagent	Phenolphthalein solution		Carbonization	

Table 2-2 (3) List of Equipment for Inspection recording

No.	Name	Specification	Pieces	Purpose of Use	Photos
1	Digital camera		6	Recording	
2	Video camera		6	Recording	

Table 2-2 (4) List of Equipment for Inspection safety

No.	Name	Specification	Pieces	Purpose of Use	Photos
1	Safety belt			Safety	
2	Helmet, Safety best, Protective glasses, Protective mask etc.			Safety	
3	Work clothes, Work boots, Gloves, etc.			Safety	

Table 2-3 Increase and Decrease of Project Cost

(Unit: Yen)

	Original Contract (7/2015)	The Fourth Revision (7/2018)	Increase or Decrease
I. Business Expenses	194,041,000	260,931,000	66,890,000
1. Direct Expenses	84,481,000	125,555,000	41,074,000
(1) Travel Expenses (Airplane)	19,651,000	35,648,000	15,997,000
(2) Travel Expenses (Others)	24,053,000	28,605,000	4,552,000
(3) General Business Expenses	21,951,000	29,886,000	7,935,000
(4) Deliverable Expenses for creating	387,000	387,000	0
(5) Equipment Expenses	13,225,000	13,809,000	584,000
(6) Re-commission Expenses	4,000,000	15,887,000	11,887,000
(7) Domestic Training Expenses	1,214,000	1,333,000	119,000
2. Direct Labor Expenses	49,800,000	61,535,000	11,735,000
3. Other Expenses	59,760,000	73,841,000	14,081,000
II. General Management Expenses	37,797,000	52,297,000	14,500,000
III. Sub-total	231,838,000	313,228,000	81,390,000
Total of consumption tax and local consumption tax	18,547,040	25,058,240	6,511,200
IV. Total	250,385,040	338,286,240	87,901,200

1-2. Input by the Bangladesh side (Planned and Actual)

Planned and actual inputs by Bangladesh side are shown in Table 2-4.

Table 2-4 Input – Bangladesh Side

Inputs	Plan (PDM ver. 1)	Actual (PDM ver. 6)
(1) Experts	1. Project Director one person 2. Additional Project Director one person 3. Project Manager one person 4. Deputy Project Manager one person 5. RHD Counterpart 6. Other Staff	1. Project Director one person 2. Additional Project Director one person 3. Project Manager one person 4. Deputy Project Manager one person 5. ACE two persons 6. SE three persons 7. DS one person 8. EE eight persons 9. SDE one person
(2) Equipment	1. Office (inside RHD) 2. Engineering Equipment / Inspection Equipment	1. Office Two rooms inside RHD Training Center One large printer and one small printer Refrigerator, Desks, Chairs 2. Inspection equipment as per approved revised TAPP, such as distance meter, camera, binocular, step ladder, and survey accessories.
(3) Project Cost	1. Travel expenses, Daily allowance, Accommodation 2. Other expenses	1. Travel expenses, Daily allowance, Accommodation 2. Other expenses

1-3. Activities

The summary of progress of activities is shown in Table 2-5.

Table 2-5 Summary of Progress of Activities

Activities	Completed	Will be completed by the end of the Project (by Nov 2018)	Will not be completed by the end of the Project (by Nov 2018)
[Activities in Output 1]			
1.1. Actual condition of bridge maintenance is reviewed	✓		
1.2. Problems / issues on bridge maintenance cycle are identified	✓		
1.3. Institutional framework of bridge maintenance is reviewed	✓		
1.4. Documents of bridge maintenance procedure and standard of staff deployment are prepared.	✓		
[Activities in Output 2]			
2.1. Existing bridge maintenance manual is reviewed and issues/problems on the manual are analyzed.	✓		
2.2. Bridge inspection / evaluation manual is updated.			
2.2.1 Bridge inspection / evaluation manual (Inspection) is updated.	✓		
2.2.2 Bridge inspection /evaluation manual (Evaluation) is prepared.	✓		
2.3. Bridge rehabilitation / strengthening manual is prepared.			
2.3.1 Bridge rehabilitation / strengthening manual (Rehabilitation/strengthening measures) is prepared.	✓		
2.3.1 Bridge rehabilitation / strengthening manual (Cost Estimate) is prepared	✓		
2.4. Manuals for Bridge maintenance are explained to RHD staff by Master Trainers (MT).	✓		
[Activities in Output 3]			
3-1. Existing BMMS is reviewed and analyzed.	✓		
3-2. Utilization of BMS is examined together by RHD.	✓		

Activities	Completed	Will be completed by the end of the Project (by Nov 2018)	Will not be completed by the end of the Project (by Nov 2018)
3-3. Function of BMS is defined and developed.	✓		
3-4. Data in existing BMMS is entered into BMS by RHD.			✓
3-5. BMS manual for administrators and users is prepared.	✓		
3-6. BMS manual is explained to RHD staff by BMS administrators.	✓		
[Activities in Output 4]			
4-1. On the job trainings (OJTs) on bridge inspection / evaluation in model area(s) are conducted with Bridge inspection / evaluation manual	✓		
4-2. OJTs on prioritizing bridges to be repaired in model area(s) are conducted by utilization of BMS	✓		
4-3. OJTs on selection of bridge rehabilitation / strengthening measures, cost estimation in model area(s) are conducted with Bridge rehabilitation / strengthening manual.	✓		
4-4. Advices on supervision of bridge rehabilitation / strengthening works are given by Expert.	✓		
4-5. Institutional capacity development plan is prepared.	✓		
[Joint Coordination Committee (JCC)]	✓		
[Monitoring]	✓		
[Seminar]	✓		
[International Seminar]			✓
[Training in Japan]	✓		

1-3-1. Activities for Output 1

Regarding "Activities for Output 1", many items were discussed while baseline survey was conducted in August, 2015 and eight workshops and finally they were summarized in Bridge Maintenance Standard.

Table 2-6 Record of WS for Output 1

No	Name of WS	Date	Participants *1
1	WS1(A1-WS1): Towards the Establishment of Bridge Maintenance Cycle (BMC)	11th Nov 2015	15
2	WS4 (A1-WS2): Solution of Issues on Maintenance Work Implementation, Estimate of Annual Work Volume, Necessity & Securing Human Resources	10th Jan 2016,	14
3	WS6 (A1-WS3): Consideration Regarding Pending Items"	17th Jan 2016	18
4	WS7 (A1-WS4): Flow of Bridge Maintenance Activities	17th Jan 2016	17
5	WS9 (A1-WS5): 1) Bridge Maintenance Management Standard (Pre-Draft) 2) Capacity Development Training Plan 3) Review of Existing Bridge Condition Survey Manual	4th Feb 2016	16
6	WS13 (A1-WS6): Bridge Maintenance Management Standard (Draft ver.1)	27th Mar 2016	17
7	WS16 (A1-WS7): Bridge Maintenance Management Standard, Enhancement of Technical Ability	10th Apr 2016	16
8	WS17 (A1-WS8): Bridge Maintenance Management Standard (Draft ver.2), Recommendations for Creating Durable Bridges	10th Apr 2016	16

*1: Project members are included.

1-3-2. Activities for Output 2

Regarding "Activities for Output 2", many items were discussed during baseline survey and ten workshops and they were finally summarized in Bridge Inspection and Evaluation Manual, Bridge Rehabilitation and Strengthening Manual. Bridge Rehabilitation and Strengthening Manual consists of two volumes. Table 2-7 shows the outline of WS related to Activities for Output 2.

Regarding Activities 2-4, at DTC (Divisional Training Course) conducted in April, 2018, at least 532 general staff of RHD were trained about Bridge Inspection and Evaluation Manual.

Table 2-7 Record of WS for Output 2

No	Name of WS	Date	Participants *1
1	WS2 (A2-WS1): Development of Bridge Inspection Manual	13th Dec 2015,	18
2	WS3 (A2-WS2): Development of Bridge Evaluation Manual		
3	WS5 (A2-WS3): Case Study of Detailed Investigation of Load Capacity	10th Jan 2016,	14
4	WS10 (A2-WS4): Inspection Procedure, Safety during Inspection & Recording, Contents/Edition Policy of Bridge Inspection Manual	13th Mar 2016	16
5	WS11 (A2-WS5): 1) Method of Evaluation of Bridge Element Types & Evaluation Criteria 2) Method of Evaluation of Entire Bridge 3) Judgment of Need for Detailed Investigation	13th Mar 2016	16
6	WS14 (A2-WS6): Bridge Inspection/Evaluation Manual [Inspection]	10th Apr 2016	18
7	WS15 (A2-WS7): Bridge Inspection/Evaluation Manual [Evaluation]	10th Apr 2016	18
8	WS18 (A2-WS8) : Development of Bridge Rehabilitation/Strengthening Manual	22nd May 2016	13
9	WS19 (A2-WS9) : 1) Development of Bridge Rehabilitation/Strengthening Manual: Part 2: Cost Estimation 2) Development of Bridge Inspection Manual: Essential Viewpoints during Inspection of Bridges.	22nd May 2016	13
10	WS21 (A2-WS10): Development of Bridge Rehabilitation/Strengthening Manual [Method]	19th Jun 2016	18
11	WS22 (A2-WS11): Development of Bridge Rehabilitation/Strengthening Manual; Part 2 : Cost Estimation	19th Jun 2016	18

*1: Project members are included.

1-3-3. Activities for Output 3

Regarding Activities for Output 3, many items were discussed during baseline survey and four workshops and they were finally summarized in Bridge Management System Manual. Bridge Management System Manual consists of four volumes, namely volume I for Bridge Management Wing, volume II for inspectors and evaluators, volume III for system administrator and volume IV for general users. Table 2-8 shows the outline of WS related to Activities for Output 3. BMS was updated based on RHD engineer's opinion and request in each seminar like as OJT, bridge site inspection in Manikganj or DTC.

BMS was developed for "Database for Bridge inventory and Result of inspection / evaluation" and "Assistance to choose targeted bridges to be remedy". Main function of BMS are as following.

- Bridge List : Bridge Inventory (including bridge shape and so on.)
- Bridge Inspection : Database of inspection result
- Bridge Evaluation : Database of evaluation result
- Bridge Remedial Measure : Calculation result of rough cost to remedy
- Bridge Remedy List : Integrated list with outputted data
- Settings, filter function to search and export the data as excel file

BMS calculates "Priority score to be remedied" by summing up "Importance score" and "Damage score". Importance score shows influence of the bridge to surrounding area, and Damage score shows soundness of the bridge. And BMS also chooses temporary remedial measure, and calculates rough remedial quantity and rough cost estimate. In order to make budget plan of bridge remedy, user can user above scores to help choosing bridges. And it become easier to show reason of targeted bridges with the scores and rough cost estimate.

Activity 3-4 is not completed yet. This is because as there were many mistakes and duplications in current BMMS database, it was difficult to transfer the data of current BMMS to new BMS database as it is. As a result, Activity 3-4 was changed so that the data of current BMMS would be transferred at the time of nation-wide bridge inspection. As the bridge inspection in model area is completed, the data of 200 bridges and culverts in model area was transferred to new BMS database after checking. As nation-wide bridge inspection is scheduled in 2018 fiscal year, the data of current BMMS data will be transferred in order.

Regarding Activity 3-6, at least 532 general staff of RHD were trained by MTs about BMS Manual at DTC carried out in April, 2018.

Table 2-8 Record of WS for Output 3

No	Name of WS	Date	Participants *1
1	WS8 (A3-WS1): Program Construction of Bridge Management System (BMS)	4th Feb 2016	16
2	WS12 (A3-WS2): Confirmation of Requirements of BMS (Items of INPUT/OUTPUT)	27th Mar 2016	19
3	WS19 (A3-WS9) : 1) Development of Bridge Rehabilitation/Strengthening Manual; Part 2 : Cost Estimation 2) Development of Bridge Inspection Manual: Essential Viewpoints during Inspection of Bridges.	22nd May 2016	13
4	WS20 (A3-WS3): Procedure and Function of Bridge Management System (BMS)	29th May 2016	16
5	WS23 (A3-WS4): Introduce of Bridge Management System	29th Jan 2016	23

*1: Project members are included.

1-3-4. Activities for Output 4

Activity 4-1, Activity 4-2 and Activity 4-3 are the activities related to OJT in model area. In original OJT plan, the explanation on Manuals, the execution of bridge inspection and evaluation in model area (Manikganj), the judgement of priority for repair works based on the results of inspection, the selection of repair method for highly prioritized bridges and the cost estimation of repair works was planned as a serial training but it became impossible under the various restrictions followed by security problems. Thereby, OJT was separated into three stages, namely OJT(1): Explanation on Manuals and Demonstration of bridge inspection and evaluation, Bridge Inspection in Manikganj: Execution of bridge inspection by MT and inputting of inspected results into BMS database, OJT(2): Determination of priority order, selection of remedial method and cost estimation of selected projects.

Bridge inspection in Manikganj was carried out by MTs themselves but JICA experts didn't join it as police escort would have been needed continuously during bridge inspection. JICA experts stayed at Dhaka and supported RHD with making of inspection plan, evaluation of inspected results and inputting inspected results into BMS database. The outline of OJT (1) and OJT (2) is shown in Table 2-9.

Table 2-9 (1) Outline of OJT (1)

Curriculum	Period	Day	Time Table				Remarks
			10:00 - 12:00	12:00 -13:30	13:30 - 15:30	15:30 - 17:30	
Inspection & Evaluation	Group A: 11th - 13th July Group B: 15th - 17th July Group C: 18th - 20th July (For 3 days)	1st Day	Explanation on Inspection	Lunch	Explanation on Evaluation	Explanation on Detailed Investigation	Bridge Inspection and Evaluation Manual
		2nd Day	Exercise on Inspection & Evaluation	Lunch	Explanation of Inspection tools & Robot Camera	Demonstration of Detailed Investigation in Training Center	Exercise Material prepared by Consultant Team
		3rd Day	Demonstration of Inspection by Robot Camera in Manikganj Division	Lunch	Bridge Inspection at the site of Sreerampur Box Culvert		Bridge Inspection at the site in Manikganj
Bridge Maintenance Management Standard & BMS	Group A: 23rd - 24th July Group B: 26th - 27th July Group C: 30th - 31st July (For 2 days)	4th Day	Explanation on Bridge Maintenance Management Cycle	Lunch	Explanation on BMS and BMS Utilization	Explanation on BMS and BMS Utilization	Bridge Maintenance Management Standard & BMS Manual
		5th Day	Transfer of Bridge Data of Manikganj Division from Current BMMS to New BMS	Lunch	Exercise on BMS Utilization	Exercise on BMS Utilization (Bridge Maintenance Needs Plan)	Exercise Material prepared by Consultant Team
Rehabilitation & Strengthening	Group A: 2nd- 3rd August Group B: 6th - 7th August Group C: 9th - 10th August (For 2 days)	6th Day	Explanation on Bridge Rehabilitation & Strengthening Method	Lunch	Explanation on Bridge Rehabilitation & Strengthening Method	Explanation on Cost Estimation	Explanation on Bridge Rehabilitation & Strengthening Manual by Consultant Team
		7th Day	Explanation on Cost Estimation	Lunch	Exercise on Bridge Rehabilitation & Strengthening Method	Exercise on Cost Estimation	Exercise Material prepared by Consultant Team

Table 2-9 (2) Outline of OJT (2)

Curriculum	Period	Day	Time Table			Remarks
			10:00 - 12:30	12:30 -13:30	13:30 - 16:00	
Bridge Management System (BMS)	Group A: 15th - 16th January Group B: 17th - 18th January Group C: 21st – 22ndJanuary (For 2 days)	1st Day	Explanation on 'Outline of the establishment of bridge maintenance plan'	Lunch	Explanation on 'Assumptions on the calculation used by BMS'	Bridge Maintenance Management Standard & BMS Manual
		2nd Day	Explanation on 'Making of EXCEL tables'	Lunch	Making of Annual Needs Report	Exercise Material prepared by JICA Consultant Team
Bridge Repair & Cost Estimation	Group A: 24th – 25th January Group B: 28th – 29th January Group C: 31st Jan – 1st Feb (For 2 days)	3rd Day	Repair Plan & Cost Estimation of Bridge-1	Lunch	Repair Plan & Cost Estimation of Bridge-2	Explanation Materials Prepared by JICA Consultants Team.
		4th Day	Repair Plan & Cost Estimation of Bridge-3	Lunch	Repair Plan & Cost Estimation of Bridge-4	

1-3-5. Joint Coordination Committee (JCC)

JCC was held 5 times. The outline of JCC is shown in Table 2-10.

Table 2-10 Outline of JCC

JCC No.	1st	2nd	3rd	Fourth	Fifth
Opening Date	30-Aug-15	28-Jan-16	5-Mar-17	3-Dec-17	29-Aug-18
Chairperson	Secretary	Secretary	Secretary	Additional Secretary	Secretary
Agenda	1. Opening Address 2. Welcome Address including Background of the Project 3. Explanation of Project Implementation Plan * Overall goal of the project * Project purpose * Output of the project * Project Implementation schedule * Allocation plan of each expert 4. Items to be Approved by the 1st JCC Meeting * PDM (Ver.1) and PO (Ver.1) * Selection of Model Division * Formation of Core Members (CM)	1. Opening Address 2. Welcome Address 3. Explanation regarding Project Progress 3-1 Decision at the 1st JCC Meeting 1) [Training in Japan] 2) [Local Staff] 3) [Stay of JICA Expert in Bangladesh] 4) [Preparation of Equipment] 5) [Other Issues] 3-2 Achievement of the project activities /Workshops (WS) and remaining activities/WS 3-3 Monitoring Sheet (Ver.2) 4. Discussion 5. Closing Address	1. Opening Address 2. Welcome Address 3. Explanation on the Materials of the 3rd JCC Meeting 3-1 Progress of the Project 3-2 Outline of the Manuals (1) Bridge Maintenance Management Standard (2) Bridge Inspection & Evaluation Manual (3) Bridge Rehabilitation & Strengthening Manual (4) Bridge Management System Manual BMS Manual for Public Users BMS Manual for System Administraters BMS Manual for Inspector & Evaluator BMS Manual for Bridge Management Wing 3-3 Detailed Plan on OJT 3-4 Review of Equipment 3-5 Monitoring Sheets 4. Discussion & Conclusion	1. Opening Address 2. Welcome Address 3. The 3rd JCC Meeting Decisions 4. Reporting 4-1 On-The-Job Training (1) 4-2 The Second Training in Japan 5. Project Schedule 5-1 Extension of Project Period 5-2 Recommendation regarding BMCDP Phase II 6. Monitoring Sheet (Ver.5) 7. Discussion & Conclusion	1. Opening Address 2. Welcome Address 3. The 4th JCC Meeting Decisions 4. Reporting 4-1 Bridge Inspection in Manikganj and OJT (2) 4-2 DTC Supporting Training 5. The Manuals (Final Draft) 5-1 Bridge Maintenance Management Standard 5-2 Bridge Inspection & Evaluation Manual 5-3 Bridge Rehabilitation & Strengthening Manual 5-4 BMS Manuals 6. Institutional Development Plan (Draft) 7. Outline of Completion Report 8. Overseas Study Program by JICA 9. BMCDP Phase-2 10. Monitoring Sheet (Ver.6) 11. Discussion & Conclusion

1-3-6. Monitoring

Monitoring was conducted 6 times. As the 3rd JCC meeting which was scheduled in July, 2016 was postponed due to security issues, Monitoring Sheet (Ver.3) and Monitoring Sheet (Ver.4) were approved at the 3rd JCC held in March, 2017. The transition of monitoring is shown in Table 2-11.

Table 2-11 Transition of Monitoring

Version No.	1	2	3	4	5	6
Submission Date	30-Aug-15	28-Jan-16	5-Mar-17	5-Mar-17	3-Dec-17	7-Sep-18
Progress Period	Up to 30-Aug-15	Up to 15-Jan-16	Up to 15-Jul-16	Up to 15-Feb-17	Up to 15-Nov-17	Up to 15-Aug-18

1-3-7. Seminar

Seminar was held for the young engineers of RHD who are in charge of bridge maintenance from February, 2018 until March, 2018. The contents of seminar were about 1st day: bridge inspection and evaluation of defects and 2nd day: BMS and utilization of BMS. The lectures were conducted in English and in Bengali. The outline of seminar (DTC Supporting Training) is shown in Table 2-12. The participants into seminar were 102 persons.

Table 2-12 Outline of DTC Supporting Training

	10:00 - 10:15	10:15 - 10:45	10:45 - 11:15	11:15-11:30	11:30 - 12:30	12:30 - 13:30	13:30 - 14:30	14:30-14:45	14:45 - 15:45
1st Day	Opening Address & Instruction	Outline of Bridge Maintenance Cycle by Mr. Hiyama	Outline of Bridge Inspection & Evaluation by Mr. Konishi	Break	Practical Exercise on Bridge Inspection & Evaluation by Mr. Mamun & Mr. Zaman	Lunch	Practical Exercise on Bridge Inspection & Evaluation by Mr. Mamun & Mr. Zaman	Break	Practical Exercise on Bridge Inspection & Evaluation by Mr. Mamun & Mr. Zaman
2nd Day		Outline of BMS by Mr. Makisima	Function of BMS by Mr. Mamot	Break	Practical Exercise on BMS by Mr. Mamun & Mr. Zaman	Lunch	Practical Exercise on BMS by Mr. Mamun & Mr. Zaman	Break	Practical Exercise on BMS by Mr. Mamun & Mr. Zaman

1-3-8. International Seminar

The holding of 100 persons-scale international seminar in which academics and experts in the field of bridge maintenance join was planned but this plan was cancelled due to the security issues which took place on 1st of July, 2016.

1-3-9. Training in Japan

Training in Japan was conducted twice.

(1) The 1st Training in Japan

The 1st training in Japan was conducted from 17th to 29th April 2016. 8 participants who played center roles in the Project participated in the training. The training schedule is as below.

Table 2-13 Participants of the 1st Training in Japan

NO	Name	Title
1	Parimal Bikash Sutradhar	Project Director
2	A.K.M. Manir Hossain Pathan	Additional Project Director
3	Md. Shafikul Islam	Project Manager
4	Md. Sohel Rana	Deputy Project Manager
5	Mohammed Shamim Al Mamun	Executive Engineer
6	Mohammad Saifuddin	Executive Engineer
7	Najmul Hasan	Executive Engineer
8	Md. Khaled Shaheed	Executive Engineer

Table 2-14 Itinerary of the 1st Training in Japan

Date	Time	Contents	Place
17th Apr	-	Arrival in Japan	-
18th Apr	10:00-12:00	JICA Briefing	JICA Tokyo International Center (TIC)
	13:00-14:00	Presentation on Issues	JICA TIC
	14:00-17:00	Lecture [1.Project Cycle Management]	JICA TIC
19th Apr	10:00-12:00	Lecture [2.Project Cycle Management]	JICA TIC
	13:30-15:30	Lecture [Bridge Maintenance Policy in Japan]	JICA TIC
20thApr	10:00-12:00	Lecture[Utilization of Training Centre]	NEXCO Engineering Takasaki TTC
	13:30-16:30	Site visit	
21stApr	10:00-12:00	State of the Art on Bridge Maintenance	Public Works Research Institute under Ministry of Land, Infrastructure, Transport and Tourism
	13:30-15:30	Site visit	
22ndApr	10:00-12:00	Visit to Bearing Fabricator	BBM Funabashi Factory
	13:30-15:30	Testing Equipment on Steel Members	Yokogawa Bridge, R&L
23rdApr	All day	Off	-
24thApr	8:00-10:30	Haneda Airport – Nagasaki Airport	-
	12:00-17:00	Nagasaki Bus Tour	-
25th Apr	10:00-12:00	lecture[Road Protector System & 3D Measurement	Nagasaki University
	13:30-15:30	Site visit (NSD Equipment)	
	16:00-18:00	Visit to major bridges in Nagasaki	-
26th Apr	9:00-13:00	Visit to Repair Works Site	Nagasaki Prefecture
	13:00-18:30	Nagasaki Airport – Haneda Airport	-
27th Apr	10:00-11:30	Bridge Maintenance Management in Yokohama City	Yokohama City
	13:00-14:00	Visit to Bridge Inspection Site or Repair Works Site	
	16:00-18:00	Lecture [Guidance for Action Plan]	JICA TIC
28th Apr	9:00-12:00	Making of Action Plan	JICA TIC
	13:00-14:30	Presentation of Action Plan	JICA TIC
	14:30-15:30	Comments & Presentation of Certificate	JICA TIC
29th Apr	-	Departure from Tokyo	-

(2) The 2nd Training in Japan

The 2nd training in Japan was conducted from 5th to 18th November 2017. 8 participants who played center roles in the Project participated in the training. The training schedule is as below.

Table 2-15 Participants of the 2nd Training in Japan

NO	Name	Title
1	Rowshan Ara Khanam	Project Director & Additional Chief Engineer, Bridge management Wing
2	Mohammad Shabbir Hasan Khan	Superintending Engineer, Planning & Data Circle
3	ShiShir Kanti Routh	Superintending Engineer, 3rd Shitalakhya Bridge Project
4	A.K. Shamsuddin Ahmed Nannu	Project Manager & Executive Engineer, BMMS Division
5	Santanu Palit	Deputy Project Manager & Sub-Divisional Engineer, BMMS Sub-Division
6	Md. Shafiul Azam	Executive Engineer, Data Base Division
7	Abdur Rahman Kaoser	Executive Engineer, Bridge Design Division - 3
8	Md. Mohibul Haque	Executive Engineer, Manikgonj Road Division, Manikgonj

Table 2-16 Itinerary of the 2nd Training in Japan

Date	Time	Contents	Place
5th Nov		Arrival in Japan	-
6th Nov	AM	Briefing Session	JICA Kansai
	PM	Discussion: Country Report Presentation Lecture: Project Cycle Management	
7th Nov	AM	Lecture and Site visit: Ibaraki Technical Training Centre	NEXCO - West
	PM	Site Visit: Bridge Repair Works (Ichikawa bridge and Chugoku Expressway), Akashi Kaikyo Bridge	
8th Nov	AM / PM	Moving to Nagoya Practice: TORAY cloth installation Observation: Product materials Moving to Kakegawa	Toray Industries, Inc.
9th Nov	AM	Site Visit: Shizuoka Plant of Kyokuto Kowa Corporation	Kyokuto Kowa Corporation
	PM	Site Visit: NEXCO Highway Service Area in Fujigawa Moving to Tokyo	-
10th Nov	AM	Lecture: Policy on Bridge Maintenance & Management in Japan	MLIT (the Ministry of Land, infrastructure, Transport & Tourism)
	PM	Lecture: Maintenance of steel bridge Site Visit and observation: Examination equipment of bridge materials	Yokogawa in Chiba
11th Nov		Off	-
12th Nov	AM	Off	-
	PM	Moving to Nagasaki	-

Date	Time	Contents	Place
13th Nov	AM	Lecture: Michimori Project Lecture: Long-term monitoring of structures by multipoint vibration sensing Lecture: Status quo of bridge maintenance and management by local government	Nagasaki University, Japan Bridge & Structure Institute, Inc.
	PM	Practice: Detail Inspection Equipment Site Visit: Major Bridges (MEGAMI-Ohashi, HIMIYUME-Ohashi) in Nagasaki	
14th Nov	AM	Observation: Bridge on the sea and Megane-bashi bridge	Nagasaki Prefecture Japan Bridge & Structure Institute, Inc.
	PM	Sightseeing in Nagasaki-city Moving to Osaka	-
15th Nov	AM	Site Visit: Bridge Inspection Works in Kyoto (YAMASHIRO-Ohashi)	Kyoto Prefecture
	PM	Sightseeing in Kyoto-city Moving to Osaka	-
16th Nov	AM/PM	Lecture: Guidance for action plan making	JICA Kansai
17th Nov	AM	Presentation of Action Plan	JICA Kansai
	PM	Evaluation Meeting / Closing Ceremony	JICA Kansai
18th Nov	-	Departure from JAPAN (KANSAI)	-

2. Achievements of the Project

2-1. Outputs and indicators

Summary of achievement status of Outputs and that for the output indicators are shown in Table 2-17.

Table 2-17 Summary of Achievement of Outputs

Indicators of Outputs		Achievement level
Output 1: Bridge maintenance framework is developed		
1.1	Documents of Bridge maintenance procedure and staff deployment are approved by RHD	Achievement level: Achieved Bridge Maintenance Management Standard was approved during the 2nd JCC.
1.2	Bridge inspection based on the bridge maintenance cycle is commenced by RHD	Achievement level: Achieved Actual Bridge inspection based on the bridge maintenance cycle (e.c. Inspection ➜ Evaluation ➜ Data input (into BMS) ➜ Planning ➜ Rehabilitation/Strengthening (Countermeasure work)) was done by MTs including C/Ps through the Bridge Inspection in Manikganj Division during Manikganj inspection and OJT (2).
1.3	Data management by utilization of BMS is commenced by RHD	Achievement level: Achieved Inputting result of inspection of all bridges in Manikganj Division was completed.
1.4	Bridge maintenance plan (annual budget and work plans) in model area(s) is prepared	Achievement level: Achieved In OJT (2) , annual budget plans in Manikganj Division was prepared with listing the bridges in the order of high priorities to be repaired based on output of BMS, and work plans was prepared with remedy measures of each bridge outputted by BMS.
Output 2: Bridge inspection / evaluation manual and Bridge rehabilitation / strengthening manual are developed		
2.1	Bridge inspection / evaluation manual is approved by RHD	Achievement level: Achieved The final draft manual preparation was completed and approved at the 5th JCC.
2.2	Bridge rehabilitation / strengthening manual is approved by RHD	Achievement level: Achieved The final draft manual preparation was completed and approved at the 5th JCC.
Output 3: Bridge management system is developed		
3.1	Data accessibility of BMS is improved	Achievement level: Approved Inputting result of inspection of all bridges in Manikganj Division was completed.
3.2	BMS manual is approved by RHD	Achievement level: Achieved The final draft manual preparation was completed and approved at the 5th JCC.
Output 4: Necessary knowledge of bridge management is enhanced by RHD staff		
4.1	75 bridge inspection MT are trained	Achievement level: Achieved 75 bridge inspection MT took OJT (1) (July to August, 2017), Bridge Inspection in Manikganj (from the end of November to December, 2017) and trained bridge inspection.
4.2	75 bridge rehabilitation MT are trained	Achievement level: Achieved 75 bridge rehabilitation MT took OJT (1) (July to August, 2017), Bridge Inspection in Manikganj (from the end of November to December, 2017) and OJT (2) (Jan. to Feb., 2018), and trained rehabilitation and cost estimation by examination of 4 bridges picked up from Manikganj area.
4.3	75 BMS administrators are trained	Achievement level: Achieved 75 BMS administrators were trained by inputting information and result of the Bridge Inspection in Manikganj Division.
4.4	Institutional capacity development plan is approved	Achievement level: Achieved Institutional capacity development plan was prepared and approved during 5th JCC.

2-2. Project Purpose and Indicators

Project Purpose is "Institutional capacity of RHD on bridge management is improved". The followings are status of achievement of the indicators for Project Purpose. Summary of achievement of indicators for Project Purpose is shown in Table 2-18.

Table 2-18 Summary of Achievement of Indicators for Project Purpose

Indicators of Outputs		Achievement level
1	Bridge maintenance cycle is commenced by RHD	In this project, 75 MTs of RHD learned Bridge maintenance cycle and trained inspection, evaluation, BMS operation, planning and Rehabilitation with model area (Manikganj Division). As a result, Bridge maintenance cycle was commenced in Manikganj Division (one division out of 65 divisions of RHD). In other divisions, Divisional Training Course was completed by EE. Bridge maintenance cycle in all Bangladesh was already prepared and it is going to commence from all Bangladesh inspection after this rainy season.
2	Necessary training based on the institutional capacity development plan is conducted by Master Trainers (MT).	Divisional Training Course based on institutional capacity development plan in Bridge Maintenance Management Standard (Draft) was carried out in 65 divisions of RHD. (The institutional capacity development plan was updated and finalized based on the project result, and was approved during 5th JCC.)

3. History of PDM Modification

3-1. Modification from Version 2 to Version 3

The authorizers of Manuals and the number of MTs were written in Version 3.

Table 2-19 Modification from Version 2 to Version 3

Output	Indicator		Reason of Modification
	Version 2	Version 3	
1. Bridge maintenance framework is developed	1-1. Documents of Bridge maintenance procedure and staff deployment are approved by XX	1-1. Documents of Bridge maintenance procedure and staff deployment are approved by RHD	Authorizer written
	1-2. Bridge inspection based on the bridge maintenance cycle is commenced by RHD	1-2. Bridge inspection based on the bridge maintenance cycle is commenced by RHD	
	1-3. Data management by utilization of BMS is commenced by RHD	1-3. Data management by utilization of BMS is commenced by RHD	
	1-4. Bridge maintenance plan (annual budget and work plans) in model area(s) is prepared	1-4. Bridge maintenance plan (annual budget and work plans) in model area(s) is prepared	
2. Bridge inspection / evaluation manual and Bridge rehabilitation / strengthening manual are developed	2-1. Bridge inspection / evaluation manual is approved by XX	2-1. Bridge inspection / evaluation manual is approved by RHD	Authorizer written
	2-2. Bridge rehabilitation / strengthening manual is approved by XX	2-2. Bridge rehabilitation / strengthening manual is approved by RHD	
3. Bridge management system is developed	3-1. Data accessibility of BMS is improved	3-1. Data accessibility of BMS is improved	
	3-2. BMS manual is approved by XX	3-2. BMS manual is approved by RHD	Authorizer written
4. Necessary knowledge of bridge management is enhanced by RHD staff	4-1. XX bridge inspection MT are trained	4-1. 75 bridge inspection MT are trained	Number written
	4-2. XX bridge rehabilitation MT are trained	4-2. 75 bridge rehabilitation MT are trained	
	4-3. XX BMS administrators are trained	4-3. 75 BMS administrators are trained	
	4-4. Institutional capacity development plan is approved	4-4. Institutional capacity development plan is approved	

3-2. Modification from Version 3 to Version 4

The number of overall goals was written in Version 4. Furthermore, regarding project purpose, one sentence was added in indicator's column.

Table 2-20 Modification from Version 3 to Version 4

	Indicator		Reason of Modification
	Version 3	Version 4	
Overall Goal			
Bridge management under RHD is enhanced	1.Annual ratio of bridge inspection conducted by RHD is increased from XX% to XX%.	1.Annual ratio of bridge inspection conducted by RHD is increased to 50%.	The number written
	2.Bridge maintenance cycle is conducted by RHD.	2.Bridge maintenance cycle is conducted by RHD.	
Project Purpose			
Bridge maintenance capacity of RHD is improved.	1.Bridge maintenance cycle is commenced by RHD.	1.Bridge maintenance cycle is commenced by RHD.	
	2.Necessary training based on the institutional capacity development plan is conducted by Master Trainers (MT).	2.Master Trainers (MTs) are trained.	Added
		3.Necessary training based on the institutional plan is conducted by Master Trainers (MT).	
Input by Bangladesh Side			
2.Facility and Equipment	1) Offices (inside RHD building)	1) Offices (inside RHD building)	
		2) Engineering Equipment/Inspection Equipment	Added

3-3. Modification from Version 4 to Version 5 and Version 5 to Version 6

Project period in PDM was modified followed by the modification of project period. Project period was until November 2nd, 2018 in Version 5 to coincide with contract period but in Version 6 to coincide with R/D, project period was re-modified to September 2nd as the period of activities at the site.

4. Others

4-1. Results of Environmental and Social Considerations

Not applicable

4-2. Results of Considerations on Gender/Pease Building/Poverty Reduction

<Version 3>

- Female engineer had been assigned to the Project since the commencement of the Project.

<Version 4>

- New female Project Director & Additional Chief Engineer, RHD has been assigned since January 2017. Although the number of female engineers who are involved in the project need to be increased, it is difficult to make it because the number of female engineers is lower than those of males relatively.

<Version 6>

- RHD and JICA Project team created an environment during Manikganj Inspection, OJT and DTC supporting training which was easy to participate for female engineers.

4-3. Other remarkable/considerable issues related/affect to the project

<Version 3>

- Current remarkable concern is that the TPP has not been approved by Bangladesh side yet. Given that the TPP is not approved, travelling allowance such as transportation costs, daily allowance and accommodation costs for OJTs participants cannot be secured. As no TPP is approved, no funds are available, thus, the immediate approval process of the TPP should be executed and completed as soon as possible.
- According to RHD, RHD has already sent the revised TPP to the Ministry. Its secretary will sign the TPP and send it to Planning Commission (Ministry of planning). The Planning Commission will approve the TPP as a final step. There is no certainty about the required time in this process. It might take even one or two months.

<Version 3>

- Based on the PDM, the project activities have been delayed due to the security reason. Plan how to catch up activities (for instance a change of the time schedule) delayed will be one of agendas for 3rd JCC.

<Version 4>

- The 3rd JCC (in July, 2016) was not held therefore the issue related to the delay of the work schedule will be an agenda of the 3rd JCC meeting (in March, 2017).

<Version 6>

- The 5th JCC (in 5th August, 2018) was put off to 29th august, 2018 due to the security reason.

III. Results of Joint Review

1. Results of Review based on DAC Evaluation Criteria

(1) Relevance

The relevance of the Project is judged as "high" from the following reasons.

Bangladesh has experienced a firm economic growth in recent years maintaining the annual GDP growth rate of about 6 percent. Along with that, freight volume has increased by approximately 8 times in the 30 years between 1975 and 2005, and the freight volume and the number of passengers has maintained an upward trend at a pace of 6-7 percent. Among the major means of transportation in Bangladesh such as inland waterway, railway and road, the rate relying on road use in both passenger and freight has exceeded 80 percent in 2005. However, new road construction is not adequately implemented against an increase of the traffic volume, and condition of existing road is deteriorating due to incompetent capacity on roads/bridges maintenance and budgetary deficit. These obstacles are hindering smooth transportation of passenger and freight.

According to the "Sixth Five Year Plan (2011-2015)", GOB defines that efficient and modern road transportation system plays an important role in the road sector for achieving "Sixth Five Year Plan" and "Vision 2021" which is the mid-term aim of Bangladesh. Furthermore, appropriate maintenance on existing roads is placed as an important issue in order to reduce costs for road users. "National Land Transport Policy (2004)" describes that enhancing maintenance capacity, securing budgets and formulating a long-term development plan are prioritized as an important policy. "Road Master Plan (2009)" formulated based on "National Land Transport Policy" mentions that maintaining asset value of roads and bridges is one of the aims to be focused.

Construction of bridges in Bangladesh has been accelerated drastically after its independence in 1971, and the number of bridges and culverts increased from 1,112 to 18,356 in 2013. Meanwhile, the rapid increase of bridges has caused frequent falls of bailey bridges (emergency bridges) and road condition has seriously deteriorated due to inadequate maintenance. Though GOB is aware of the necessity of the capacity development on bridge management, it is yet to be implemented. This results in bridges fall before the arrival of the end of their durable years.

"Japan Country Analytical Work" (April 2013) regards the development of whole-country traffic network as an important issue and "Japan's Country Assistance Program for Bangladesh (June 2012)" stipulates that traffic infrastructure should be developed in order to promote the movement of person and freight. The Project fully complies with the above country analytical work and country assistance program.

(2) Effectiveness

The effectiveness of the Project is judged as "high" from the following reasons.

The four outputs have been achieved. One Standard and three Manuals were approved by Joint Coordination Committee (JCC). Using these Manuals on-the-job trainings were carried out and over 600 persons of engineers and technicians were trained. This covers over 25% of all RHD staff. As the budget for the bridge inspection has been secured, the bridge inspection will start in 2018 fiscal year in whole country.

Bridge management system (BMS) software has been developed. Bridge inspection was carried out in model area and the inspected results were inputted into BMS database. By utilizing BMS, project priorities were determined. After the nation-wide bridge inspection completes, the actual conditions of whole bridges and culverts are grasped and effective and practical maintenance plan will be established.

RHD staff gained sufficient knowledge concerning bridge maintenance and are going to start practical bridge maintenance management cycle with nation-wide scale.

Achievement level of the indicators of the project purpose is positive and the effectiveness of the project is high.

(3) Efficiency

The efficiency of the Project is judged as "moderate" from the following reasons.

- Except [Activity 3-4: Data in existing BMMS is entered into BMS by RHD], all activities completed. However, at the point of project period and project cost, it is difficult to say that the efficiency of the Project is high although the activities at the site were greatly restricted due to security problems.
- Project period was extended from 30 months to 38 months due to security reasons.
- OJT at model area was originally planned as one-month continuous course. One-month course is: [Explanation of Manuals ⇛ Bridge Inspection ⇛ Evaluation of Inspected Results ⇛ Determination of Project Priority by utilizing BMS ⇛ Setup of Work Plan ⇛ Cost Estimation]. One-month training course was separated into three stages due to the restriction followed by security problems. As a result, the explanation on Manuals was conducted in July, 2017, bridge inspection was carried out in November to December, 2017 and the determination of project priority by using BMS was implemented in January to February, 2018. In spite of the fact that the net period of OJT was shortened half month, the period of OJT continued from June, 2017 until February, 2018.
- Both project cost and project period were increased. This increase was mostly affected by security problems.

(4) Impact

The impact of the Project is judged as "high" from the following reasons.

Nation-wide bridge inspection will be carried out in this fiscal year. Based on the inspected results, practical maintenance plan will be established. Repair works will start according to the maintenance plan in next fiscal year. After the completion of repair works, the review and modification of maintenance plan will be conducted. In three years, the first maintenance cycle will complete. Nation-wide bridge inspection will complete up to 100 % and bridge maintenance cycle will start in whole country in this fiscal year (2018). Assumed impact is realized.

(5) Sustainability

The sustainability of the Project is judged as "high" from the following reasons.

- Based on the results of project activities and present bridge condition, RHD should take major directions to ensure the safe, secure, comfortable and reliable road network for the public. In order to implement the bridge management strategy, necessary setups were discussed in a series of WSs, such as institutional arrangement, human resources development plan, bridge management procedures, budgetary arrangement etc. The results of discussions are documented and incorporated in the outputs of the Project (Bridge Maintenance Management Standard and Institutional Development Plan). Furthermore, as Bridge Inspection and Evaluation Manual, Bridge Rehabilitation and Strengthening Manual and BMS Manual were approved at JCC which secretary preside together with Bridge Maintenance Management Standard and Institutional Development Plan, the contents of bridge maintenance management will be implemented continuously.
- Furthermore, in DTC, over 500 RHD staff in 133 Sub-Divisional Offices was trained regarding bridge inspection, bridge soundness evaluation, BMS operation, repair design and cost estimate. This was the training course for nation-wide bridge inspection and at least 133 bridge inspection teams already exist in whole country. After this rainy season, these inspection teams will start nation-wide bridge inspection all at once. The composition of an inspection team and the period required for nation-wide bridge inspection are shown in Table 3-1 and Table 3-2 respectively. Each office can complete the inspection for bridges or culvert in the tables.
- The training on bridge maintenance management for RHD staff by MTs will be conducted continuously according to [Institutional Development Plan Part II].
- Before this project starts, RHD only has simple inspection manual and bridge falling due to overloading took place almost every month. In spite of that situation, country wide bridge inspection wasn't carried out more than 10 years. Through this project, various kind of technical manuals were created under the collaboration with RHD engineers (core members). Furthermore,

over 600 staff of RHD were trained using created Manuals. This figure covers almost all Class I engineers of RHD. If bridge maintenance is carried out according to approved Manuals, the reliability for bridges will be enhanced and as a result the number of bridges falling will decrease.

Table 3-1 Composition of Bridge Inspection Team

Position	Numbers	Post	Class	Academic Background	Numbers/Sub-Division
Senior Inspector	1	SDE	Class I	16yrs, university	1
Inspector	1	SAE	Class II	13yrs, junior college	3
Assistant Inspector	2	Staff	Class III	10yrs, high school	5
Driver	1	Staff	Class IV	8yrs, junior high school	10
Traffic Safety Guard	1	Staff	Class IV	8yrs, junior high school	

Table 3-2 Average Inspection Period per Sub-Division

	Numbers	Numbers of Sub-Division	Average Operation Rate	Average Inspection Days / Sub-Division
Culvert	13,838	133	7 culverts/day/team	15
Bridge	4,517		3 bridges/day/team	12

2. Key Factors Affected Implementation and Outcomes

Key factors affected implementation and outcomes of the Project and measures taken for overcoming the problems caused by the factors are shown in Table 3-1.

Table3-1 Key Factors affected Implementation and Outcomes of the Project and Measures Taken for Overcoming the Problems Caused by the Factors

Key Factors Affecting Implementation and Outcomes	Measures Taken for Overcoming of the Problem Caused by the Factors
< Impact on the Project by the Incident on 1st July 2016 >	
Because of the incident on 1st July 2016, JICA prohibited staying in Bangladesh from July 2016 to December 2016. After December 2016, JICA experts can visit and stay in Bangladesh under a given condition by JICA as following, ➢ Maximum person who can stay in Bangladesh at the same time is 3 person. ➢ Maximum staying time of a visiting Bangladesh is 2 weeks. ➢ JICA experts can't go out of Dhaka area without JICA's permission. Basically, JICA experts should avoid activity in unsafe situation like as field survey.	JICA consultant team suggested JICA for extension of project period and JICA approved it. End of project period was changed from 2nd March 2018 to 2nd November 2018. JICA consultant team arranged manning schedule in Bangladesh based on the rule. As the result, all scheduled and additional seminars were completed. In OJT 1, JICA consultant team applied JICA for going to Maniganj and JICA approved it. JICA experts went to bridge site in Manikganj with enough security.
< Changing of Development Policy of BMS > In starting a project, it was planned that new BMS (Bridge Management System) was constructed with Microsoft Office, because of simplicity of using and updating the system. After investigation of old database system (BMMS) and interview with MIS section, RHD gave strong demand to construct new BMS from scratch with Computer language, not with Microsoft Office.	JICA experts considered the RHD's request and judged the request was proper for project objective. JICA consultant team remade design plan and JICA gave approval for it. JICA consultant team contracted with Atom AP, system development corporation in Bangladesh, and developed BMS as scratch application with computer language.
< Unusual Rainy Weather on Rainy Season in 2017 > It was planned that site inspection in model area (Manikganj) starts after end of usual rainy season, around October 2017. However, rainy season in 2017 was longer term and accompanied by heavy rain.	Start of site inspection in Manikganj was put off to beginning of November 2017. The inspection was completed by end of December 2017.

Key Factors Affecting Implementation and Outcomes	Measures Taken for Overcoming of the Problem Caused by the Factors
< RHD's Requests for Additional Lectures > RHD required to hold following lectures by JICA experts. 1) Additional lecture in order to make more complete DTC (Divisional Training Course) in March 2018 2) Lecture about BMS systematic topics for staffs of new BMS system section in May 2018 3) Additional lecture about Bridge Management Cycle for New Executive Engineer in July 2018	JICA consultant team approved of RHD requests and held seminars as followings, 1) DTC Supporting Training DTC Supporting Training was held 2 days for each 4 groups, total 8 days on February and March 2018. JICA experts taught Bridge management. 102 SDE joined the training. 2) BMS Training for MIS Person BMS Training for MIS person was held for a month in May 2018. System manager of JICA consultant team taught them about system, how to use and manage BMS. 3 MIS person joined the training. They will be in charge of new system section of BMS. 3) Additional OJT Additional OJT was held 3 days on July 2018. JICA experts taught Bridge management. 27 new EE joined the training.
< Delay in Install BMS into RHD Server > Development of BMS was completed end of April 2018. However, because of budget planning, RHD couldn't prepare new server machines and server room for BMS by end of April 2018.	JICA consultant team assisted RHD to make tender document and construct new server. Install operation of BMS was completed in September 2018.
< Delay in JCC3 on July 2016> JCC3 was planned in July 2016. However, because of the incident, JICA experts couldn't enter Bangladesh.	JCC3 was held in 5th March 2017.
< Delay in JCC5 on early August 2018 > JCC5 was planned on 5th August 2018. However, because of security problem, JICA experts couldn't go to Secretariat area.	JCC5 was held on 29th August 2018.

3. Evaluation on the results of the Project Risk Management

The following important lessons learned from the similar JICA project implemented in the past in the Philippines, Kyrgyz and Sri Lanka were identified by the Project at the time of planning (See Ex-post Evaluation Summary of the Project).

> Technical transfer becomes more effective by offering opportunities for experiencing the inspections and repairs in the field in a pilot project.

> Contents of the manuals to be developed should reflect the needs of the counterpart personnel and become appropriate in technical level of them, by reviewing the existing manuals with them and identifying their technical level at the beginning.

The Project had taken the above-mentioned lessons and brought a successful result for production of Outputs as follows:

> JICA consultant team conducted a baseline survey on the existing manuals and technical level of the RHD staff on Bridge Management, and shared the result with the counterpart personnel at the Work Shop

> JICA consultant team made manuals and BMS by collaborating with RHD, reflecting opinions and requests of RHD in Work Shop, OJT, Site Inspection in Manikganj and other seminars. As the result, the manuals and BMS became appropriate for Bangladesh.

> MTs, who were trained in the Project, became trainers and conducted the bridge management training (DTC) in each division. They had provided answers to the questions raised by the participants in the seminar, too. This experience deepened their understanding of the bridge management and expanded their capacity as trainees.

4. Lessons Learnt

There are some lessons learnt in institutional aspect, technical aspect and financial aspect.

1) Institutional Aspect

- Legalization of inspection, permanent installation of bridge inspection team, new installation of bridge division in each zone and development of BRRL were recommended in Manuals and at JCC but they are not secured yet. As the issues regarding the increase of new organization and personnel are the issues which involve Ministry of Road Transport and Bridges, Ministry of Planning, Ministry of Finance and ECNEC (Executive Committee of the National Economic Council chaired by Prime Minister), it is very difficult for RHD to solve them.
- In order to solve this issue, the dispatch of long-tem JICA Expert to Road Transport and Highways Division, Ministry of Road Transport and Bridges and the strong backup from JICA and Embassy of Japan to JICA Expert are required.

2) Technical Aspect

- In OJT(1), the exercise of bridge inspection was planned so as to cover typical bridge types (concrete girder bridge, steel girder bridge, Bailey bridge and box culvert). However, due to the delay of OJT influenced by security problems and several changes of project schedule, OJT (1) had to hold in July of rainy season. As the entering into under bridges was impossible because of increased rain water, the exercise of bridge inspection was only conducted at a box culvert. Thereby, the effectiveness and efficiency of technology transfer decreased.

- In order to evaluate bridge defects correctly, the knowledge about bridge design is required. Bridge design should have been incorporated in OJT curriculum.

- There was strong request concerning the countermeasures against overloading of vehicles and the development of repair design manual from RHD side. This request should be handled at the next stage of the Project.

- The Project was more effective if Technical manuals are also written in Bengali.

- As a local company in Bangladesh was in charge of software development, the communication with RHD was very smooth while JICA consultant was not in Bangladesh. It can be said that the efficiency of the Project increased compared to the original plan.

3) Financial Aspect

- TAPP approval takes too much time. Rationalization of financial system is required. However the matters related to finance together with organization and personnel are very difficult to be solved as RHD tends to think that these matters are outside their scopes.

- Road Maintenance Fund Board Act was approved by Parliament of Bangladesh in July, 2013. Although five years have already passed since the approval, road maintenance fund hasn't been mobilized yet. As RHD was avoiding the discussion regarding this matter as a political matter, it was difficult to find a clue for solution.

- Routine maintenance budget and PMP minor budget are the mixed budgets of roads and bridges. By separating bridge budget from road budget, the bridge budgets for routine maintenance and PMP Minor become powerful budget for preventive maintenance. Although this matter has been recommended since the beginning of the Project, the agreement from RHD hasn't been obtained.

IV. For the Achievement of Overall Goals after the Project Completion

1. Prospects to achieve Overall Goals

The Overall Goal of the Project is "Bridge management under RHD is enhanced". The prospects for achievement of indicators for Overall Goal are shown in Table 4-1.

Table 4-1 Prospects for achievement of Indicators for Overall Goal

	Indicators for Overall Goal	Prospects for Achievment
1	Actual ratio of bridge inspection conducted by RHD is increased to 50%.	RHD is planning nation-wide bridge inspection in this fiscal year. Actual ratio of bridge inspection in this fiscal year reached 100%. However the continuity of bridge inspection is most important. As bridge inspection is conducted every two years based on Inspection Manual, the ratio of bridge inspection reached 50% every year.
2	Bridge maintenance cycle is commenced by RHD.	Maintenance cycle is already commenced in Model area (Manikganj). However, maintenance cycle is not completed yet in Model area. First maintenance cycle of whole country will be completed in 3 years accoring to Bridge Inspection and Management Manual.

2. Plan of Operation and Implementation Structure of Bangladesh

RHD will start nation-wide bridge inspection after the rainy season of this fiscal year and the budget for bridge inspection is also secured. The training course for bridge inspectors was held at 65 divisions of RHD and at least 532 bridge inspectors were trained about bridge inspection and BMS utilization. Equipment for bridge inspection was also purchased. BMS software was installed in the server of MIS circle which manages the information of RHD collectively and is now waiting for the inputting of inspected results. After the nation-wide bridge inspection, 5 year bridge maintenance plan and annual maintenance plan are established and according to these plans, bridge repair and strengthening works will be executed.

3. Recommendations for RHD

Recommendations which were introduced in Bridge Maintenance Management Standard and at JCC Meetings are as follows.

1) Institution and Organization
- Legalization of bridge inspection
- Permanent installation of bridge inspection team
- New installation of bridge division in each zone
- Institutionalization of bridge maintenance management training
- Development of BRRL

2) Technology
- Completion of Bridge Maintenance Cycle in Model Area
- Nation-wide expansion of project outputs
- Enhancement of technology level of inspectors
- Introduction of cutting-edge repair and strengthening method
- Provision of bridge design manual, quality control manual, completion inspection manual
- Permanent keeping of as-built drawings
- Provision of standard design drawings
- Accumulation of information on repair materials and repair method

3) Finance
- Rapid introduction of preventive maintenance
- Rapid mobilization of road fund
- Separation of road budget and bridge budget regarding routine maintenance and PMP minor

4. Monitoring Plan from the end of the Project to Ex-post Evaluation

The RHD should report to the JICA Bangladesh Office progress reports, in particular the 1st national bridge periodic inspection. The JICA Bangladesh office will provide advice on progress as necessary.

ANNEX 1 : Results of the Project
(List of Dispatched Experts, List of Counterparts, List of Trainings, etc.)
ANNEX 2 : List of Products (Report, Manuals, Handbooks, etc.) Produced by the Project
ANNEX 3 : PDM (All versions of PDM)
ANNEX 4 : R/D, M/M, Minutes of JCC (copy)
ANNEX 5 : Monitoring Sheet (copy)

Separate Volume : Copy of Products Produced by the Project

1 : Bridge Maintenance Management Standard
2 : Bridge Inspection and Evaluation Manual
3 : Bridge Rehabilitation and Strengthening Manual：Part 1 Method
4 : Bridge Rehabilitation and Strengthening Manual：Part 2 Cost Estimate
5 : Bridge Management System (BMS) Manual：for System Administrators
6 : Bridge Management System (BMS) Manual：for Bridge Management Wing
7 : Bridge Management System (BMS) Manual：for Inspector & Evaluator
8 : Bridge Management System (BMS) Manual：for Public Users
9 : Institutional Capacity Development Plan
10 : BMS original data. (DVD)

Contents of APPENDIX

ANNEX 1: Results of the Project

< Japan side >

POSITION	NAME
Yoshimitsu HIYAMA	Team Leader/ Bridge Maintenance Plan
Ikuo HARAZAKI	Bridge Inspection
Toshiyuki KONISHI	Bridge Evaluation
Rikiya IIZUKA	Bridge Maintenance Plan (2)
Toshiyuki KONISHI	Bridge Maintenance Plan (3)
Kenichi HIDA	Detailed Survey
Yasuo KOSAKA	Bridge Rehabilitation・Strengthening/Bridge Evaluation (2)
Yukitomo TATSUMI	Cost Estimate
Kengo MAKISHIMA	Bridge Management System
Kanji OHNO	Bridge Management System (2)
Chiaki YAMADA	Project Monitoring
Kengo MAKISHIMA	Project Monitoring (2)
Hideaki YASASHI	Coordinator/ Bridge Maintenance Plan (Assistance)

<Bangladesh side>

NAME	POSITION
Rowshan Ara Khanam	Project Director & Additional Chief Engineer, Bridge management Wing
Mohammad Shabbir Hasan Khan	Superintending Engineer, Procurement Circle
A.K.M. Manir Hossain Pathan, PEng.	Additional Chief Engineer, Cumilla Zone, Former Additional Project Director
A.K. Shamsuddin Ahmed Nannu	Project Manager & Executive Engineer, BMMS Division
Md. Shafikul Islam	Executive Engineer, Sunamganj Road Division, Former Project Manager (PM)
Santanu Palit	Deputy Project Manager & Executive Engineer, Environment Division
Shishir Kanti Routh	Superintending Engineer, 3rd Shitalakhya Bridge Project
Md. Shafiul Azam	Executive Engineer, Chief Engineer's Office
Mohammed Shamim Al Mamun	Executive Engineer, Chief Engineer's Office
Mohammed Saifuddin	Executive Engineer, Western Bangladesh Bridge Improvement Project, Former Comilla Road Division
Nazmul Hasan	Executive Engineer, Bridge Design Division-1
Md. Khaled Shaheed	Superintending Engineer, HDM Circle
Mohammad Moniruzzaman	Deputy Secretary, Former Executive Engineer, Road Design & Standard Division
Abdur Rahman Kaoser	Executive Engineer, Bridge Design Division - 3
Md. Mohibul Haque	Executive Engineer, Administration & Establishment
Khan Md. Kamrul Ahsan	Additional Project Director & Superintending Engineer, Planning & Data Circle

ANNEX 2: List of Products (Report, Manuals, Handbooks, etc.) Produced by the Project

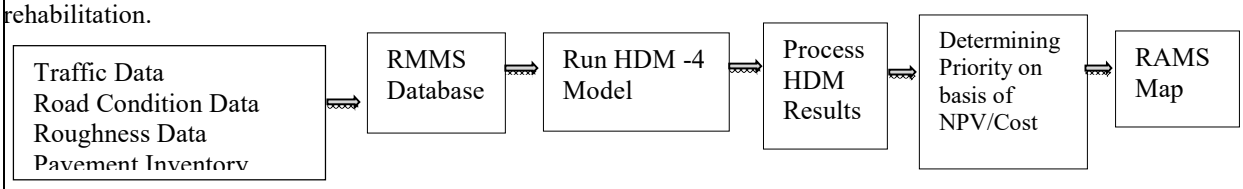
Output	Contents	Products (Manual and Software)
1	Bridge Maintenance Plan	Bridge Maintenance Management Standard
		Institutional Development Plan Part.1
2	Bridge Inspection	Bridge Inspection and Evaluation Manual
	Bridge Evaluation	
	Detailed Survey	
	Bridge Rehabilitation / Strengthening	Bridge Rehabilitation and Strengthening Manual：Part 1 Method
	Cost Estimate	Bridge Rehabilitation and Strengthening Manual：Part 2 Cost Estimate
3	Bridge Management System	Bridge Management System (BMS) Manual：for System Administrators
		Bridge Management System (BMS) Manual：for Bridge Management Wing
		Bridge Management System (BMS) Manual：for Inspector & Evaluator
		Bridge Management System (BMS) Manual：for Public Users
		BMS Software (DVD)
4	Institutional Capacity Development Plan	Institutional Development Plan Part.2

Output	Contents	Products (Report)
1	Questionnaire to RHD	Question/Request(August, 2015) and the Answer (November, 2015)
	Baseline Survey	The Report on the Site Visit Conducted to Select Model Area for OJT (August, 2015)
		Report on Site Survey of Existing Bridges along N-5 in Sirajganj Division (September, 2015)
4	Advices on supervision of bridge rehabilitation/strengthening	Survey Report on Condition of Shahbazpur Bridge (March, 2018)
		Survey Report on Condition of Damdama Bridge (March, 2018)
		Report on Site Survey of Nolka Bridge along N-405 in Sirajganj Division (April, 2018)

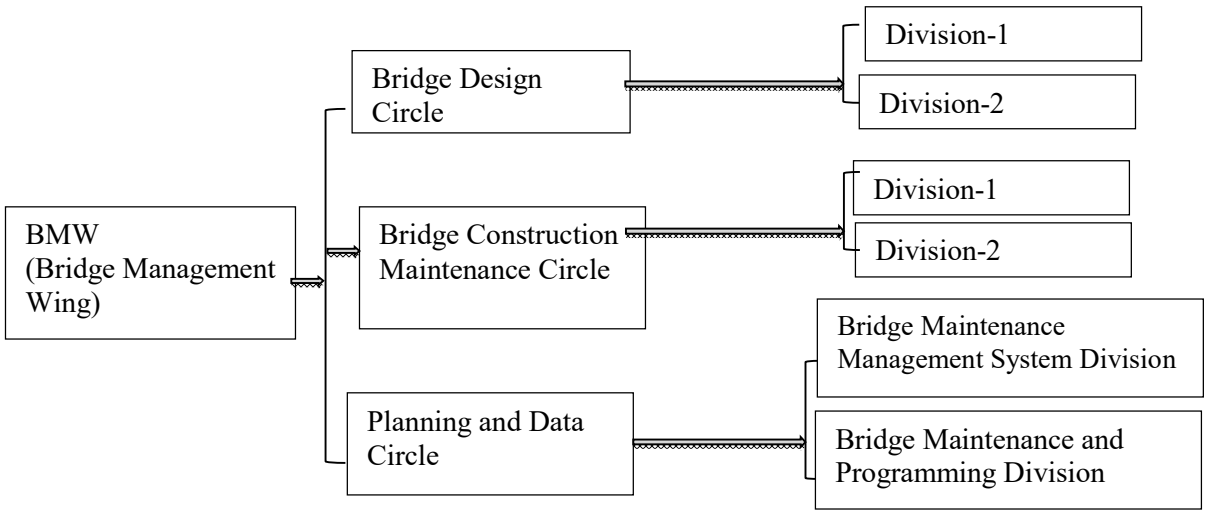
No	Question/Request
1. Bridge maintenance policy	
1-1	Maintenance policy and plan concerning roads and bridges
1-2	Assistance from other donors for bridge maintenance works such as bridge inspection, soundness evaluation, repair works and excessive load vehicle control
2. Bridge maintenance budget	
2-1	Transition of bridges construction and maintenance budget in the past five years
2-2	Breakdown of budget resources including budget from road maintenance fund.
2-3	Amount of toll collected by toll roads and bridges and its way of use
2-4	Allocation system of road and bridge maintenance budget
2-5	Amount of budget which was requested, allocated and consumed for bridge maintenance works in the past 5 years
2-6	In the long term programme regarding bridge maintenance and rehabilitation, is the latest inspection result reflected?
2-7	Breakdown of maintenance budget separating bridge budget from road budget respectively on routine maintenance, PMPminor and PMP major
2-8	Problems concerning maintenance budget resources
2-9	Countermeasures to address the ploblems on budget resources
2-10	Way of preparation for short-term & middle term bridge maintenance program.
2-11	Budgets of each Zone for bridge routine maintenance works, PMP minor and major works and new bridge construction projects with number of implemented bridges in past 5 years. Answer table is given by Attached paper.
3. Organizations in charge of bridge maintenance works	
3-1	Organogram and work contents (HQ, Zone, Circle, Division, Sub.-Division)
	Number of personnel, rank & position, year of experience after graduation (HQ, Zone, Circle, Division, Sub.-Division)
3-2	The name of the organizaiton/managerial post in charge of following tasks
3-2-1	Conduction of bridge inspection works.
3-2-2	Bridge soundness evaluation.
3-2-3	Selection of the bridges to be repaired or reconstructed.
3-2-4	Prioritization of the bridges to be repaired or reconstructed.
3-2-5	Judgement on whether repair or reconstruction.
3-2-6	Preparation of the bridges list for repair or reconstruction.
3-2-7	Conduction of bridge repair works
3-2-8	Operation of BMMS including data input.
3-3	The number of staff of RHD Head Office, Zone Office, Circle Office, Division Office and Sub-division Office belonging to following categories.
3-3-1	The number of staff in the office by section and rank.
3-3-2	The number of staff mainly in charge of bridge maintenance works by section and rank.
3-3-3	The number of staff mainly in charge of highway maintenance works by section and rank.
3-3-4	The number of staff in charge of both bridge and highway maintenance.
3-4	Flow of works and procedures from a bridges inspection work to implementation of a bridge repair works with the name of each work/procedure, and the name of organizations in charge of each work/procedure.
3-5	Problems and way of solution concerning bridge maintenance and management
4. Existing Manuals/Guidelines to be applied for bridge maintenance works	
4-1	Do you have any manual/guideline/specification for a bridge design, construction works, quality control, cost estimation and procurement?
4-2	Do you have any bridge maintenance manual/guideline/specification?
4-3	Do you have any manual/guideline/specification to be applied for countermeasures against disaster.
4-4	Status of utilization regarding bridge maintenance manuals/guidelines
4-5	Management for the publishment, distribution,and explanation of bridge maintenance technical standards.
5. Training for the RHD'sstaffs in charge of bridge maintenance works	
5-1	Following information are currently to be requested for the establishment of Human Resources Development Program. In case several programs are carried out, information is to be given per program.
5-1-1	The name of Human Resources Development Programs for RHD's staffs in charge of bridge maintenance works.
5-1-2	The name of organizer of the programs.
5-1-3	The type of the Human Resources Development Programs such as a lecture and a seminar.
5-1-4	The venue of the programs such as RHD Training Center in Dhaka.
5-1-5	The period of the programs.
5-1-6	The frequency of the programs.
5-1-7	The organization which participants belong to and their position/clas, and number of participants.
5-2	The organization which the instructor/lecturer of the program belong to and their position/class rank if they belong to RHD/MOC.
5-3	What kind of technical training was implemented for bridge inspector's capacity development implemented for thepast 5 years?
5-3-1	Inside the country: total number of trainees, training curricurum, training text material
5-3-2	JICA training in Japan: list of atended tarinees.

6. Existing bridge inventory/history file	
6-1	Are the history of maintenance/rehabilitation activities described in **bridge inventory file**?
6-2	Is Bridge Inventory including **history of maintenance/rehabilitation activities updated** based on the latest inspection result?
6-3	How can be the data updated and by what organization?
6-4	Is it possible that **"Construction Completion Drawings"** are utilized for bridge inspection report and bridge inventoy?
6-5	2. Inspection Record
6-6	Are there any **special bridegs** such as suspension bridge, cable-stayed bridge, arch bridge?
6-7	Is the same inspection manual applied for these bridges?
6-8	How many bridges consisted of **weathering steel** are managed in RHD?
7. Bridge inspection works	
7-1	Are the **inspection & evaluation records**（BCS-1～3, PBI）properly filed?
7-2	Are **"Field Sketch"** included in addition to the defficiency photos or not in the inspection record form?
7-3	Is annual **bridge survey/inspection implementation programme** established and documented?
7-4	Do you have any **problem/issue on bridge inspection works** and do you have any idea to solve the problem/issue?
7-5	What kind type of **contract for outsoucing** regarding bridge inspection work are applied?
7-6	To make the best use of **"Bridge Condition Survey Manual, May 2014"**, what are **the issues to be solved** (redarding applicability to inspection work, usability, points to be improved) ?
7-6-1	forms of inspection & evaluation（BCS-1～3）
7-6-2	usability of inspection & evaluation result
7-6-3	frequency of survey
7-6-4	system for carrying out inspection & evaluation（BCS-1～3, PBI）
7-6-5	input into format（BCS-1～3）
7-6-6	category of structural types of bridge and culvert
7-6-7	category of bridge element types
7-6-8	critelia of evaluation
7-6-9	Is the correct **human resources** defined in the bridge inspection manual? What peronnel consists of inspection team?
7-6-10	Is internal rule or regulation on **"Safety Management"** including safety measures, emergency measures, safety equipments used? Is internal rule or regulation on "Traffic Control" used? If yes, please prvide them to us.
7-6-11	To evaluate defeciencies observed **by distant view** how or what kind of criteria is applied to evaluation generally? "Inspected by DISTANT view"is to be described in inspection record?
7-6-12	How can be defficiency photographs taken when inspected obtained? We would like to use that photographs to be used on the visual criteria in revised inspection manual.
7-7	What kind of **equipment & tools** for bridge bridge inspection, repair and improvement works?
7-7-1	Do you have an **inventory** of equipment and tools?
7-7-2	Do you take any **measures** to maintaine equipment & tool?
7-7-3	Are ther any problem/issue on maintenance of bridge maintenance equipment & tool? Do you have any idea to solve the problem/issue?
7-7-4	Are necessary equipments & tools for bridge inspection and safety i**ncluded in the Survey/Inspection Manua**l? What are they?
8. Detailed inspection	
8-1	The existence of tests on concrete
8-1-1	Carbonation depth
8-1-2	Chloride ion concentration
8-1-3	Concrete compressive strength.
8-1-4	Elastic modulus of concrete
8-1-5	Coring
8-2	What organizaitons carry out the concrete tests of the above.
8-3	The method of concrete tests of the above
8-4	The existence of the bridge which caused the alkali-aggregate reaction
8-5	What organizaitons that carry out the alkali-aggregate reaction tests, and the method of test
8-6	The existence of the test carried out on the ffatigue crack of the steel bridge
8-6-1	What organization carry out following tests for identifying steel cracks ?
8-6-2	Penetration Test
8-6-3	Magnetic-Particle Test
8-6-4	Ultrasonic Test
8-10	What organizaitons carry out the crack tests of the above
8-11	We would like to interview to the enterprise that carry out the tests

9. Bridge condition soundness evaluation	
9-1	Existence of evaluation record of bridge soundness condition
9-2	Do you consider the causes and progression in decision of damage evaluation
9-3	The existence of damage photographs to be used on the evaluation manual
9-4	What kind of evaluation work, do you charge commision to private consultants
9-5	Is the evaluation report of a damaged bridge including the proposal method of repair/strengthening
10. Bridge repair/strengthening works	
10-1	Private companies which can carry out bridge maintenance works(by work-scale)
10-2	Maintenance work classification & contents (routin, PMP minor, PMP major etc)
10-3	Performance & records of bridge maintenance/rehabilitation works
10-4	Contract system on bridge maintenance/rehabilitation works
10-5	Existence of bridge maintenance/rehabilitation work plan
10-6	Ploblems & way of solution concerning bridge maintenance/management works
10-7	Existence of bridge life prolongation coutermeasures
10-8	Bridge replacement option What criteria for the whole bridge replacement/rehabilitation of existing bridge is applied?
10-9	Existence of preventive maintenance countermeasures
10-10	Bridge Inventory including history of maintenance/rehabilitation activities
10-11	Existing status of implementation of bridge maintenance works.
10-12	What kind of a contract type is applied for bridge maintenance works?
10-13	Outlines of each bridge improvement project implemented past 5 years such as a type of bridges, pupose and contents of improvement works, and contract method.
10-14	Performance & records of emergency response in the case of serious damage is found
10-15	Performance & records of emergency response in the case of serious damage is found
10-16	How many repair and strengthening contracts per year were made in past 5 years for bridges
10-17	What kind of concrete repair method were chosen in last years, the existence of repair documents(drawing and photos)
10-18	What kind of concrete beam strengthening method were chosen in past 5 years, the existence of documents(drawing and photos)
10-19	What kind of steel girder repair method were chosen in last years, the existence of repair documents(drawing and photos)
10-20	What kind of steel girder strengthening method were chosen in last years, the existence of repair documents(drawing and photos)
10-21	Have you found the fatigue crack on the steel girder, How did you repair
11. Cost estimation for bridge maintenance works	
11-1	Regulation and manual of cost estimation for construction of new bridge and box culvert
11-2	Regulation and manual of cost estimation for maintenance and rehabilitation of existing bridge and box culvert
11-3	Unit price of labors, equipment/ plant and materials for construction and repair works
12. Bridge management system (BMS)	
12-1	Bridges and culverts list which RHD manages(bridge type, bridge length, completion year, damade rank, bridge width, sub-div. in charge etc.) Incorporate bridges and culverts which are not yet included in BMMS database.
12-2	How is the implementation status regarding "Review" on the website of BMMS in RHD Databases? That is, “The BMMS Database upgradation is going on. The information being shown here is **under review.**”
12-3	Are there any problem/issue on existing BMMS?
12-4	Do you have any idea to solve above problem/issue?
13. Over loading vehicle issues	
13-1	The existence of concerning Law/Reguration regarding excessive loading vehicles. Present condition of enforcement actiivities against excessive loading vehicles and andctual status of enforcement effects. Measuring results of axis loads and vehicle weights by enforcement activities.
13-2	Decision method of the load restriction (BCS-1)
13-3	The existence of the data that reveals design live load of bridges

No	Question/Request
	1. Bridge maintenance policy
1-1	Maintenance policy and plan concerning roads and bridges. * The RMMS database and the HDM-4 model are used to derive yearly maintenance budget demand (Routine, Periodic, Rehabilitation and Reconstruction etc work classes) for RHD. HDM Circle with its manpower conducts road roughness survey using Roughometer III. The other surveys such as Road Condition Survey (RCS), Traffic Count Survey (TCS) and Pavement Inventory Survey (PIS) are carried out by engaging consultants. These survey data are stored in RMMS Database. This database is the input of HDM-4 model analysis. By analysis, location, extent and type maintenance requirement for the RHD Road network are identified and prioritized in accordance with NPV/Cost ratio. The analysis also develop a 5-year investment plan to meet acceptable levels of service provision for the RHD network and provide a database for preparing RAMS map that combines all relevant information and shows decision makers where they can most effectively allocate funds for maintenance and rehabilitation.  The HDM-4 Model analysis is carried out in the two sequences. Firstly, all roads have been analyzed to assess the overall long-term maintenance need of the RHD road network. Secondly ongoing projects, which are in progress and were not completed before the start of Roughness survey, have been excluded from the HDM run to project the immediate maintenance requirement for avoiding the duplication. The maintenance works and their associated priorities are shown in a GIS map known as RAMS map There is no such procedural programme for Bridge work. A system should be developed for bridges.
1-2	Assistance from other donors for bridge maintenance works such as bridge inspection, soundness evaluation, repair works and excessive load vehicle control. * Few/No assistance from other donors.
	2. Bridge maintenance budget
2-1	Transition of bridges construction and maintenance budget in the past five years. * Given in the table attached.
2-2	Breakdown of budget resources including budget from road maintenance fund. * The total allocation of road maintenance fund for FY-2015-2016 is Tk. 136,845.39 Lac amount this the break down is as follows : a) PMP (Major) - Tk. 82,800.00 Lac b) PMP (Bridge) - Tk. 15,000.00 Lac c) PMP (Minor) - Tk. 30,073.50 Lac d) Routine Maintenance - Tk. 7,500.00 Lac e) Emergency Maintenance - Tk. 1,000.00 Lac e) Emergency Rehabilitation Project - Tk. 471.89 Lac.
2-3	Amount of toll collected by toll roads and bridges and its way of use * Toll collection for FY 2014-2015 from roads is Tk. 132,414.40 Lac. and Bridges is Tk. 12,000.00 Lac. It is deposited as Government Revenue.

No	Question/Request
2-4	Allocation system of road and bridge maintenance budget. * The allocation of road and bridge maintenance budget is done to each division against its roads and bridges on the basis of HDM needs report, demand of the division. The demand of field division is again verified in the chief engineer office.
2-5	Amount of budget which was requested, allocated and consumed for bridge maintenance works in the past 5 years . * Expressed in the table.
2-6	In the long term programme regarding bridge maintenance rehabilitation, is the latest insection result reflected? * Latest inspection result will be reflected in RHD's long term maintenance program.
2-7	Breakdown of maintenance budget separating bridge budget from road budget respectively on routine maintenance, PMP minor and PMP major. * Expressed in the table.
2-8	Problems concerning maintenance budget resources . * The main problem regarding budget of maintenance fund is its insufficiency. HDM Needs report following we for example needed Tk. 7772.00 crore. for FY 2013-2014 for road and Bridge maintenance, but we got Tk. 123.00 and 964.00 crore for FY 2013-2014 which is only 16% of the total demand.
2-9	Counter measures to address the problems on budget resources. * Donor's attention may be drawn to resource constraint.
2-10	Way of preparation for short-term & middle term bridge maintenance program. * Utilization of Bridge condition survey report.
2-11	Budgets of each Zone for bridge routine maintenance works, PMP minor and major works and new bridge construction projects with number of implemented bridges in past 5 years. * Table enclosed.
	3. Organizations in charge of bridge maintenance works
3-1	Organogram and work contents (HQ, Circle, Division, Sub-Division) * Link: RHD web (www.rhd.gov.bd) --- RHD data base --- Organization Data base (Internet version) --- Chief Engineer's office---.
3-2	The name of the Organization/managerial post in charge of following tasks. * RHD data base.
3-2-1	Conduction of bridge inspection works. * There is no periodical programme of bridge inspection work. Bridge condition survey is done in 2004/2005 for first time. Bridge condition survey is done portly thorough EBBIP in 2013.
3-2-2	Bridge soundness evaluation. * No tools, no technology, no specific skills, no trained person for soundness evaluation of bridges.
3-2-3	Selection of the bridges to be repaired or reconstructed. * According to the report of field office. Selected list is approved by the ministry.

No	Question/Request
3-2-4	Prioritization of the bridges to be repaired or reconstructed. * Existing damage condition is evaluated for taking decision whether repair or reconstruction is needed. The availability of fund/ resources is also taken into consideration., According, classification of roads National Highway is given first priority then regional highway and Zilla road.
3-2-5	Judgement of whether repair or reconstruction. * Same.
3-2-6	Preparation of the bridges list for repair or reconstruction. * There is no annual programme for the preparation of bridge list for repair or reconstruction. According to the report of field office. Selected list is approved by the ministry.
3-2-7	Conduction of bridge repair works. * Routine repair is done by RHD field offices. For major repair contractors are engaged.
3-2-8	Operation of BMMS including data input * Existing BMMS has not the facility to update.
3-3	The number of staffs of RHD Head Office, Zone Office, Circle Office, Division Office and Sub-division Office belonging to following categories. * Stated in the RHD web data base.
3-3-1	The number of staffs in the office by section and rank. * Design circle/const & maintain circle/P&D circle and BMW. 
3-3-2	The number of staffs mainly in charge of bridge maintenance works by section and rank. * Staff of RHD field offices.
3-3-3	The number of staffs mainly in charge of highway maintenance works by section and rank. * Field office perform the highway maintenance work as per RHD organogram.

No	Question/Request
3-3-4	The number of staffs in charge of both bridge and highway maintenance. * The staff of field offices does this.
3-4	Flow of works and procedures from a bridges inspection work to implementation of a bridge repair works with the name of each work/procedure, and the name of organization in charge of each work/procedure. Flow diagram of Approval. * Section office---> Sub-division office---> Division office--->Circle office--->Zone office. ACE--->CE--->MRTB. Implementation of work is done by Division offices with the assistance of Sub division and section offices. For minor and routine repair work, program is approved by ACE (Zone office) with the recommendation from field staff (Sub-Assistant Engineer/Sub-Divisional Engineer/Executive Engineer).
3-5	Problems and way of solution concerning bridge maintenance and management. * Problems are the theme of BMCD and solutions will be the outcome of the project.
	4. Existing Manuals/Guidelines to be applied for bridge maintenance works
4-1	Do you have any manual/guideline/specification for a bridge Design, Construction works, Quality control, Cost estimation and procurement? * For design of RCC & PC girder bridge RHD have " RHD Bridge Designer's handbook"-2nd Edition(Published 1999). It is handbook based on AASHTO Edition 16 (1996). The handbook was done by Bridge Improvement & Maintenance Project Phase 2(BIMP-2). For Construction works and quality control RHD has own Specification(vol 3 of 4). RHD Schedule of Rates is used for cost estimation. PPR is followed for any procurement.
4-2	Do you have any bridge maintenance manual/guideline/specification? * We have several manual/guideline/Specification which has been produced by the consultant of EBBIP project(Published May 2014). These are as follows: 1.Material for preparation of Bridge Maintenance Needs Report, 2.Major Repair Manual. 3.Bridge Maintenance Standard 4.Bridge Condition survey Manual 5.Routine Maintenance Works and Minor Repair Manual.
4-3	Do you have any manual/guideline/specification to be applied for counter measures against disaster. * We have not any manual/guideline/Specification to be applied for counter measures against disaster of Bridges.
4-4	Status of utilization regarding bridge maintenance manuals/guidelines. * RHD Bridge maintenance is not properly done by following bridge maintenance manuals/guidelines.
4-5	Management for the publishment, distribution and explanation of bridge maintenance technical standards. * When one manual /guideline/Specification is published by one project then concern authority of that project is responsible to publish and distribute of that specification.

No	Question/Request
5. Training for the RHD's staffs in charge of bridge maintenance works	
5-1	Following information are currently to be requested for the establishment of Human Resources Development Program. In case several programs are carried out, information is to be given per program. * There is no information.
5-1-1	The name of Human Resources Development Programs for RHD's staffs in charge of bridge maintenance works. * **Fiscal Year 2013-2014 & 2014-2015** 1. Maintenance of pot-hole bearings of bridge-Seminar. 2.Quality Control of Bridge Construction-Lecture. 3. Material Test & Quality Control of Bridge/Culverts. 4. Construction Site Management. **Fiscal Year 2015-2016** **Training:** 1. Construction & Supervision work of Bridge/Culverts. 2. Material Test & Quality Control of Bridge/Culverts. 3. Restoration & Retrofitting Techniques of Bridges. 4. Base isolation device installation, management & Maintenance. **Seminar:** Application of Weathering Steel Technology for RHD Bridge Construction.
5-1-2	The name of organizer of the programs. * RHD Training Center (RHDTC).
5-1-3	The type of the Human Resources Development Programs such as a lecture and a seminar. * Class Lecture, On job Training & Seminar.
5-1-4	The venue of the programs such as RHD Training Center in Dhaka. RHDTC, Chief Engineer's Conference Room.
5-1-5	The period of the programs. * Training-2/3/5/7/10 days Seminar-1 day
5-1-6	The frequency of the programs. * Seminar-At least two times in a year. Training-At least three times in a year.
5-1-7	The organization which participants belong to and their position/class, and number of participants. * Designation-CE, ACE, SE, EE, SDE, AE, SAE, number of participants-At least 80 in a Seminar. EE, SDE, AE, SAE, ARO, work Assistant, number of participants-At least 25 in a Training program.
5-2	The organization which the instructor/lecturer of the program belong to and their position/class rank if they belong to RHD/MOC. * Roads & Highways Department, Rank-SDE/EE/Se/ACE/Project Director.

No	Question/Request
5-3	What king of technical training was implemented for bridge inspector's capacity development implemented for in past 5 years? * No Such training yet.
5-3-1	Inside the country : total number of trainees, training curriculum, training text material. * N/A.
5-3-2	JICA training in Japan: list of attended trainee's * 1. MD. SHAHADAT HOSSAIN, Executive Engineer, Bridge Design Division-1, East 2. MD. YOUSOUF, Executive Engineer, Bandarban. 3. MD. ABDUR RAHMAN KAOSER, Executive Engineer, Bridge Design Division-2, East
	6. Existing bridge inventory
6-1	Is it possible that "Construction Completion Drawings" are utilized for bridge inspection report and bridge inventory? * Based on availability of "AS built drawings" in some cases. When bridges are built earlier, it is difficult to collect "as built drawing". In this case assessment is done on the basis of present condition.
6-2	Is Bridge Inventory including rehabilitation history of maintenance/rehabilitation activities updated based on the latest inspection result? * Up dated partly under EBBIP. in 2014.
6-3	Are the history of maintenance/rehabilitation activities described in bridge inventory file? * Not described in bridge inventory file. But in annual programme approved by ACE, we can see the repair works done on the which bridges/culverts.
6-4	How can be the data updated and by what organization? * Appointing consultant with the support from exiting RHD setup.
	7. Bridge inspection works
7-1	Existence of bridge inspection records. * RHD has a primary data base on bridges which is shown on RHD web site. This BMS need to be up dated. About one third of the bridges were surveyed in 2013 under EBBIP.
7-2	What kind type of contract regarding bridge inspection work are applied? * By appointing consultant as per PPR.
7-3	If inspection work is outsourced by contract, please inform the process of bidding and the contents of its implementation of work. * As per PPR (Public Procurement Regulation).
7-4	Existence of annual bridge inspection programme. * We have not definite programme. Field offices do the inspection of individual bridge and culverts as the part of their responsibility. But it is not sufficient.

No	Question/Request
7-5	Can we see it if you have? * Field offices do not maintain the record of inspection normally. But in case of emergency field office keep the record inspection.
7-6	Does bridge inspection work implemented along with annual bridge inspection programme? * Not according to programme.
7-7	How many bridges consisted of weathering steel are managed in RHD? * Data not available at present. But there is a plan to construct some weathering steel bridges under WBBIP.
7-8	Are there any special bridges such as suspension bridge, cable-stayed bridge, arch bridge? * The 3rd Karnafully is a cable-stayed bridge in RHD. The bridge located at chittagong over karnafully river.
7-9	Is the same inspection manual applied for these bridges? * RHD has no specific idea about this.
7-10	Is the correct manpower resource defined in the bridge inspection manual? What personnel consists of inspection team? * In "Bridge Condition Survey Manual May 2014" a team is defined for inspection work. SDE or a nominated SAE will be team leader. Who will be assisted by an work assistant and two flagmen. Team leader may be a AE. Discussion is needed.
7-11	Is internal rule or regulation on "Safety Management" including safety measures. emergency measures, safety equipments used? Is internal rule or regulation on " Traffic Control" used? If yes, please provide them to us. * The following manuals are published by the Ministry of Road Transport and Bridges under BRTA (Bangladesh Road Transport Authority) which are also applicable for Roads and Bridges. 1. National Road Safety Strategic Action Plan, 2002-2004 2. Road Safety Audit Reports. 3. Road Safety Education Hand Book for Children and Adult Pedestrians in Rural Areas. 4. Road Safety Engineering toolkit. 5. Road Safety Training Documents. All the above documents are available in RHD web Site. There is no rule or regulation on " Traffic Control" in RHD.
7-12	Are " Field Sketch" included in addition to the deficiency photos or not in the inspection record form? * In some cases, "Field sketch" are included in the inspection report. But it is not done in every case.
7-13	To make the best use of "Bridge Condition Survey Manual, May 2014", what are the issues to be solved (regarding applicability to inspection work, usability, points to be improved)? * The survey form may be more simplified. The manual may be included some cases of damages which lead to the failure of the bridges. A discussion may be held on the improvement of the manual.
7-14	To evaluate deficiencies observed by distant view or what kind of criteria is applied to evaluation generally? "Inspected by DISTANT view" is to be described in inspection record? * "Inspected by DISTANT View" may not be effective for planning and taking decision. So it is not necessary to include it in the inspection record.

No	Question/Request
7-15	How can be photographs of deficiencies taken when inspected obtained? We would like to use that photographs to be used on the visual criteria in revised inspection manual. * Photograph should be taken properly for damage bridges and should be included in inspection report.
7-16	Do you have any problem/issue on bridge inspection works and do you have any idea to solve the problem/issue? * There are many problems regarding inspection works. ie lack skilled staff, equipments and technologies etc.
7-17	What kind of equipment & tool for bridge maintenance, repair and improvement works? * Very conventional equipment and tools are used at present. A discussion is needed to improve in this work.
7-18	Equipments & tools for bridge inspection and safety. *Discussion needed.
7-19	Are necessary equipments & tools for bridge inspection and safety included in the inspection manual? What are they? * May be included other sophisticated equipment/instrument. Suggestion is needed in this case.
7-20	Do you have an inventory of equipment and tools? * Not definite
7-21	Do you take any measures to maintain equipment & tool? * Not definite
7-22	Are there any problem/issue on maintenance of bridge maintenance equipment & tool? * At present few equipments are maintained. There is not specific problems related to this.
7-23	Do you have any idea to solve above problem/issue? * Do not have specific idea.
7-24	Existence of inspection & evaluation records (BCS-1-3, PBI). * Partly.
7-25	Present issues of "BRIDGE CONDITION SURVEY MANUAL". * Need to be improved.
7-25-1	Problems and solution concerning the three forms of inspection & evaluation (BCS-1-3). * Need simplification.
7-25-2	Problems and solution concerning to use inspection & evaluation result. * Inspection & evaluation result should be incorporated in BMMS. But existing BMMS is not updated. and it is not possible to update it.
7-25-3	Problems and solution concerning frequency of survey. *There is no annual survey programme. BCS is performed occasionally. Lack of skilled manpower/staff, lack of resources and lack of technology/equipment are the problems of frequent /annual survey.

No	Question/Request
7-25-4	Problems and solution concerning the system for carry out inspection & evaluation (BCS-1-3, PBI). * Need specific/periodic program. The no of staff of RHD field office should be increased and trained.
7-25-5	Problems and solution concerning to enter in format (BCS-1-3). * Unknown, Since the matter is not verified and survey is not performed by RHD staff. Detail will be discussed latter.
7-25-6	Problems and solution concerning the applicable structural types of bridge and culvert. * It will not be a problem when trained up of field officers.
7-25-7	Problems and solution concerning the applicable element types of bridge and culvert. * The same Q.
7-25-8	h) Problems and solution concerning the criteria of evaluation. * Sometime it is a problem for evaluation of “Extent of Damages”.
7-26	Performance & records of PBI. * No separate record for PBI.
	8. Detailed inspection
8-1	The existence of tests on concrete. * As per RHD specification.
8-1-1	Carbonation depth. * The test is not carried out in BRRL.
8-1-2	Chloride ion concentration. * The test is not carried out in BRRL.
8-1-3	Concrete compressive strength. * The test is carried out in BRRL.
8-1-4	Elastic modulus of concrete. * The test is not carried out in BRRL.
8-1-5	Coring. * The test is not carried out in BRRL.
8-2	What organizations carry out the concrete tests of the above. * BRRL carry out concrete compressive strength test of serial 8-1-3.
8-3	The method of concrete tests of the above. * The method of concrete compressive strength test is attached herewith.

No	Question/Request
8-4	The existence of the bridge which caused the alkali-aggregate reaction. * Information not available.
8-5	What Organizations that carry out the alkali-aggregate reaction tests, and the method of test. * The test is not carried out in BRRL.
8-6	The existence of the test carried out on the fatigue crack of the steel bridge. * Information not available.
8-6-1	What organization carries out following tests for identifying steel cracks? * Information not available.
8-6-2	Penetrant Test. * The test is not carried out in BRRL.
8-6-3	Magnetic-Particle Test. * The test is not carried out in BRRL.
8-6-4	Ultrasonic Test. * The test is not carried out in BRRL.
8-10	What organizations carry out the crack tests of the above. * The test is not carried out in BRRL.
8-11	We would like to interview to the enterprise that carry out the tests. * May be discussed about interview time schedule.
9. Bridge condition soundness evaluation	
9-1	Existence of evaluation record of bridge soundness condition. * Not recorded.
9-2	Do you consider the causes and progression in decision of damage evaluation. * Not methodically.
9-3	The existence of damage photographs to be used on the evaluation manual. *Damage photograph should be used on the evaluation manual.
9-4	What kind of evaluation work, do you charge, commission to private consultants. * In case of large structure, consultants are engaged.
9-5	Is the evaluation report of a damaged bridge including the proposal method of repair/strengthening. * No/Not active.

No	Question/Request
	10. Bridge repair/strengthening works
10-1	Private companies which can carry out bridge maintenance work (by work-scale). * Work is performed adopting tendering process. Any private party qualifying in the tender do the maintenance work.
10-2	Maintenance work classification & contents (routine, PMP minor, PMP major etc). *Maintenance work is classified into three class based on the nature and extent/scale of work. Routine: Very small and applicable to all kind (road/bridge/others) of repair where mainly laborious method is adopted. PMP (Minor): Applicable to both roads and Bridges. PMP (Major): This includes PMP (Roads) and PMP (Bridge/Culvert).
10-3	Performance & records of bridge maintenance/rehabilitation works. * Not Systematically.
10-4	Contract system on bridge maintenance/rehabilitation works. * As per PPR-(Public Procurement Regulation).
10-5	Existence of bridge maintenance/rehabilitation work plan. * Not active
10-6	Problems & way of solution concerning bridge maintenance/management works. * Lack of inspection, lack of skilled staff, lack of technology, lack of equipment.
10-7	Existence of bridge life prolongation countermeasures. * None.
10-8	Bridge replacement option What criteria for the whole bridge replacement/rehabilitation of existing bridge is applied. * Extent of damage.
10-9	Existence of preventive maintenance countermeasures. * Not known and practiced.
10-10	Bridge Inventory including history of maintenance/rehabilitation activities. * Not maintained. But it is the purpose of this project.
10-11	Existing status of implementation of bridge maintenance works. * Many bridges are needed to repair/reconstruct, But due to resource constraint bridge maintenance/replacement work is done on priority basis.
10-12	What kind of a contract type is applied for bridge maintenance works? * Mainly open Tendering Method following PPR. Online Tendering is applicable.
10-13	Outlines of each bridge improvement project implemented past 5 years such as a type of bridge, purpose and contents of improvement works, and contract method. * Need wide discussion. Information may be given latter.

No	Question/Request
10-14	Performance & records of emergency response in the case of serious damage is found. *Record is not systematic. But field office which do this work, maintain files..
10-15	Performance & records of emergency response in the case of serious damage is found. * Ans. in previous Q.
10-16	How many repair and strengthening contracts per year were made in past 5 years for bridges. * Repair/strengthening contracts are few number. Mainly replacement/reconstruction work is done. List will be given latter.
10-17	What kinds of concrete repair method were chosen in last years, the existence of repair documents (drawing and photos). * Not systematic.
10-18	What kinds of concrete beam strengthening method were chosen in past 5 years, the existence of documents (drawing and photos). * Not have knowledge.
10-19	What kinds of steel girder repair method were chosen in last years, the existence of repair documents (drawing and photos). * Not have knowledge.
10-20	What kinds of steel girder strengthening method were chosen in last years, the existence of repair documents (drawing and photos). * Not present, Not recorded.
10-21	Have you found the fatigue crack on the steel girder, How did you repair. * No data record.
	11. Cost estimation for bridge maintenance works
11-1	Regulation and manual fo cost estimation for construction of new bridge and box culvert. * RHD Schedule of Rate is followed.
11-2	Regulation and manual fo cost estimation for construction and rehabilitation of existing bridge and box culvert. * Same.
11-3	Unit price of labours, equipment/plant and materials for construction and repair works. * Same.
	12. Bridge maintenance system (BMS)
12-1	Bridges and culverts list which RHD manages (Bridge type, bridge length, completion year, damage rank, bridge width, sub-div, in charge etc.) Incorporate bridges and culverts which are not yet included in BMMS database. * Existing BMMS contains old data and need update. This data base does not have sufficient information. New BMMS is needed.

No	Question/Request
12-2	How is the implementation status regarding " Review" on the website of BMMS in RHD Databases? That is, "The BMMS Database upgradation is going on. The information being shown here is under review." * It is not possible to update existing BMMS. New BMMS is necessary to be developed.
12-3	Are there any problem/issue on existing BMMS? * There are no updating facilities of BMMS.
12-4	Do you have any idea to solve above problem/issue? * New BMMS should be developed.
	13. Over loading vehicle issues
13-1	The existence of concerning Law/Regulation regarding excessive loading vehicles. Present condition of enforcement activities against excessive loading vehicles and actual status of enforcement effects. Measuring results of axis loads and vehicle weights by enforcement activities. * There is a draft for "Policy for Axle load control of Motor Vehicle, June 2012."
13-2	Decision method of the load restriction (BCS-1). * "Policy for Axle load Control of Motor Vehicle" may be followed for BCS-1 form.
13-3	The existence of the data that reveals design live load of bridges. *Traffic data available in HDM (Highway Data Management) unit which is used by design unit.

Attached table

Bridge maintenance and construction budget

BDT.lacs

Zone	Financial year	Routine maintenance budget	PMP minor		PMP Major		Construction	
			Amount of budget	Number of bridges	Amount of budget	Number of bridges	Amount of budget	Number of bridges
Barisal	2010	40.00	346.00		150.00	1	1515.12	2
	2011	58.00	350.00		305.65	1	1125.00	1
	2012	75.00	650.00		1960.91	2	1700.61	3
	2013	65.00	300.00		3176.55	3	5389.15	5
	2014	100.00	350.00		997.88	1	4767.89	7
Chittagong :	2010							
	2011							
	2012							
	2013							
	2014							

Comilla :	2010							
	2011							
	2012							
	2013							
	2014							
Dhaka :	2010							
	2011							
	2012							
	2013							
	2014							
Gopalganj :	2010						997.08	3
	2011		28.34	10			290.91	1
	2012		27.30	10	97.0200	5	846.26	2
	2013		33.94	11	950.6600	7	729.71	3
	2014		31.80	11	564.6600	6	21550.00	5
Khulna :	2010							
	2011							
	2012							
	2013							
	2014							
Rajshahi :	2010	6.00	483.00	8				
	2011	467.00	33.47	6	240.35	1		
	2012	35.68	15.00	3	239.60	1	147.71	
	2013	8.00	90.18	6	898.04	3	1305.01	
	2014			5		3	495.87	17
Rangpur :	2010	36.00	38.59	3	33.05	4	1650.65	10
	2011	51.00	75.60	4	482.88	2	2283.46	12
	2012	72.00	65.85	5	135.93	2	1533.96	7
	2013	91.50	0.00	0	0.00	0	548.92	1
	2014	17.60	41.00	5	113.41	9	2092.22	6
Sylhet :	2010							
	2011							
	2012							
	2013							
	2014							
Mymansingh	2010		4.00	8	91.32	1	5127.91	3
	2011		3.00	3	160.36	1	1294.41	2
	2012		28.07	6	59.63	1	2093.74	2
	2013		7.00	6			735.15	5
	2014		23.88	10	298.08	1	282.93	1

Report on
Site Survey of Existing Bridges
along N-5 in Sirajganj Division

4 September, 2015

Joint venture of
Japan Structure and Bridges Institute Inc. (JBSI)
Oriental Consultants Global Co., Ltd.. (OCG)
Japan Bridge Engineering Center (JBEC)

Outline

1. Purpose 1) Understanding of the present situation of the existing bridges in order to proceed the project
   2) Accessibility for close and distant visual inspection
2. Date 23-24 August, 2015
3. Bridges to be surveyed 10 Bridges managed by Sirajganj Division
4. Attendants Nine JICA Expert of the Consultant guided by the staff of Sirajganj Division Office

Table 1 List of the Surveyed Bridges

No.	Zone	Division	Road No	LRP Name	Structure Name	Chainage (km)	Bridge Type	No of Spans	Total Length (m)	No of Beams	Year of Construction	Width (m)
6	Rajshahi	Serajganj	N-5	176a	Bhuyagati Bridge	173.833	RCC Girder Bridge,	3	73.7	3	1975	7.37
10	Rajshahi	Serajganj	N-5	140a	Jugnidaha Bridge	138.201	RCC Girder Bridge,	3	53.4	4	1975	8.6
14	Rajshahi	Pabna	N-5	118a	Punduria Bridge	117.143	RCC Girder Bridge,	5	81.4	4	1963	7.09
15	Rajshahi	Pabna	N-5	126a	Vitapara Bridge	125.093	RCC Girder Bridge,	3	76.3	3	1965	7.16
19	Rajshahi	Sirajganj	R-451	7a	Chondi Das Bridge	6.561	Bailey with Steel Deck,	2	58.8	0	1985	8.35
21	Rajshahi	Serajganj	N-5	128a	Goilhar Bridge	127.046	RCC Girder Bridge,	3	43.5	4	1968	7
26	Rajshahi	Serajganj	N-5	127a	Palgari Bridge	126.806	RCC Girder Bridge,	3	43.08	4	1968	7.1
27	**Rajshahi**	**Serajganj**	**N-5**	**158a**	**Purbodalua Brid**	**155.583**	**RCC Girder Bridge,**	**3**	**78.35**	**3**	**1965**	**7.03**
47	Rajshahi	Serajganj	N-5	172a	Notun Dhoh Bridge	169.626	RCC Girder Bridge,	3	43.8	4	1972	7.52
48	**Rajshahi**	**Serajganj**	**N-5**	**179a**	**Dhatia Bridge**	**176.746**	**RCC Girder Bridge,**	**3**	**54.9**	**3**	**1975**	**7.45**
66	**Rajshahi**	**Sirajganj**	**R-451**	**1a**	**Naiori Bridge**	**0.907**	**Bailey with Steel Dec**	**2**	**50**	**X**	**1980**	**8.35**

Bold: The summary of the surveyed result is attached.

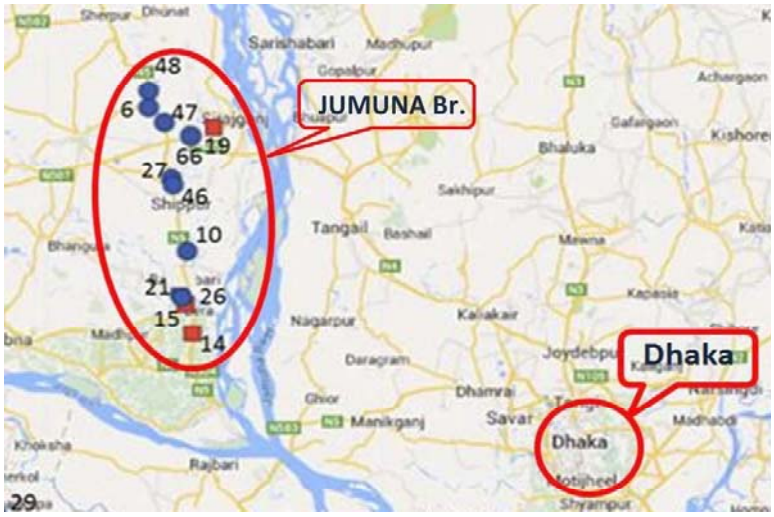


Figure 1 Location of the Surveyed Bridges

1. Location

Zone:	Rajshahi		Circle:	Pabna	Division:	Sirajganj	SubDivision :	Sirajganj-1
Road No.:	N5	Road Name:	Dhaka (Mirpur)-Utholi-Paturia- Natakhola-Kashinathpur- Bogra-Rangpur-Beldanga- Banglabandh Road				Chainage:	155.583
Structure ID:	111501		Structure No.:		Structure Name	**Purbodalua Bridge**		

2. Summary of Defficiencies

Element	Defficiencies	
Approaches		
Guide Posts	----------	
Slope Protection	----------	
Toe Wall	----------	
Railing	Damaged concrete railing (both side), Photo 1 and 6	
Side Walk	No side walk, Photo 2	
Deck	Severe damage at concrete deck over the additional pier, covered with temporary steel plates, Photo 3	
Concrete Beam	Need to pay attention at Gerber-hinges (crack, spalling), Photo 5	
Steel Beam	----------	
Truss	----------	
Bailey	----------	
Abutment		no access
Pier	Additional pier, Photo 1	
Wing Wall		no access
Pier Cap	----------	
Bearing Seat	Accumulated debris need to remove around bearings	
Bearing	Indirect support at the pier(concrete block between pier and superstructure), Photo 4	
Expansion Joint	Functional disorder/deformation, need to repair at Gerber-hinges, Photo 5	
Pile Cap	----------	
Foundation Protection	----------	

3. Comment

1) Concrete deck is severely damaged, due to the structural change of support (additional pier).

   The steel plates layed on the deck as the temporary remedial measure is too thin for strengthening.

2) RCC beams need to pay attention periodically at Gerber-hinges (progress of crack, spalling).

3) Break of railing may lead to an accident of road users. This damage is suggested to be rehabilitaited urgently.

4) The superstructure is supposed to be RCC girder, not PC girder whichi is listed on RHD Database.
   The year of construction is 1965.

4. Photo

Photo 1 Side view, additional pier under Gerber-hinge

Photo 2 Bridge Surface, damaged RCC railing

Photo 3 Damaged surface with steel plate as temporary measure

Photo 4 Indirect support (concrete block)

Photo 5 Damaged expansion joint above Gerber-hinge

Photo 6 Break of railing

1. Location

Zone:	Rajshahi	Circle:	Pabna	Division:	Sirajganj	SubDivision:	Sirajgonj-1
Road No.:	R451	Road Name:	Nalka-Sirajganj Road			Chainage:	0.907
Structure ID:	100072	Structure No.:		Structure Name	**Naiori Bridge**		

2. Summary of Defficiencies

Element	Defficiencies
Approaches	Unevenness and pavement crack of approach surface, Photo 2
Guide Posts	----------
Slope Protection	Washed away of approach shoulder, Photo 3
Toe Wall	----------
Railing	No railing
Side Walk	No side walk
Deck	Cracks of steel deak plate, Photo 5
Concrete Beam	----------
Steel Beam	----------
Truss	----------
Bailey	Minor corrosion
Abutment	no access
Pier	no access
Wing Wall	no access
Pier Cap	----------
Bearing Seat	Sediment is deposited around bearings, Photo 4
Bearing	no access
Expansion Joint	no access
Pile Cap	----------
Foundation Protection	----------

3. Comment

1) Due to high water-level in rainy season, we could not inspect the components under the bridge.

2) The collapse of the masonry behind the tment is caused by erosion.
In order to prevent slope failure, repair is required.

3) By the level difference between the approrch road surface and bridge pavement surface, cracks of deck plate is caused due to impact of wheel load. It requires replacement of pavement for maintaining flatness.

4) By the impact of the wheel load, the crack has occurred at the deck plate surface.
It needs cover plate reinforcement, or weld repairs.

5) Due to accumulation of debris around the bearing, the functional damage in movement may occur.
Accumulated debris should be removed out at daily maintenance work.

6) Loading capacity of Bailey Bridge is considered to be limited.

7) Installation of railing is proposed from the view point of safety of pedestrians .

4. Photo

Photo 1 Side view of Bridge

Photo 2 Unevenness and pavement crack of approach

Photo 3 Collapsed masonry of approach shoulder

Photo 4 Accumulated debris around bearings

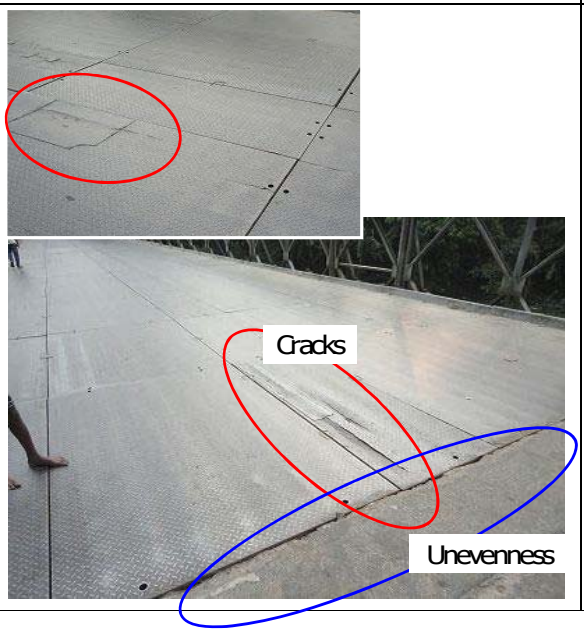


Photo 5 Cracks of Deak Plate and unevenness of surface

Photo 6 Lower surface of steel deck (H-type steel) with minor corrosion

1. Location

Zone:Rangpur	Circle:Bogra	Division:Bogra	SubDivision:Sherpur (Bogra)
Road No.:N5	Road Name:Dhaka (Mirpur)-Utholi-Paturia- Natakhola-Kashinathpur- Bogra-Rangpur-Beldanga- Banglabandh Road		Chainage:176.746
Structure ID:111517	Structure No.:	Structure Name:**Dhatia Bridge**	

2. Summary of Defficiencies

Element	Defficiencies
Approaches	Minor pavement crack, Photo 2
Guide Posts	----------
Slope Protection	----------
Toe Wall	----------
Railing	Missing (10 m) and spalling/rebar exposure due to vehicle collision, Photo 3 and 4
Side Walk	----------
Deck	no access
Concrete Beam	no access
Steel Beam	----------
Truss	----------
Bailey	----------
Abutment	no access
Pier	no access
Wing Wall	no access
Pier Cap	no access
Bearing Seat	no access
Bearing	no access
Expansion Joint	Buried expansion joint under pavement with water leakage, Photo 5 and 6
Pile Cap	----------
Foundation Protection	no access

3. Comment

1) Railing is missing and severely damaged due to vehicle collision.
And spalling and exposure of reinforcing bar due to corrosion will lead to break of railing.
From the viewpoint of safety of road users, this break of railing is suggested to be rehabilitated urgently.

2) The components under the superstructure ware not observed due to difficulty of access.

3) Abnormal vibration was detected with heavy traffic passing.
The superstructure of this bridge vibrates horizontally as well as vertically.

4) The followings are considered as the cause of horizontal vibration.
Suspected scoured Pier
Insufficient stiffness of superstructure (structural deficiency)

5) These suspected causes may indicate insufficient structural safety of the bridge.
Therefore, detailed investigation is required to identify the the location of damage in the structural member, causes/sources of damage, interactions with other damage at other components.
The items of this detailed investigation are as follows;
Measurement of vibration (vibration frequency and vibration mode)
Detailed inspection of scour by diver

4. Photo

Photo 1 Side view

Photo 2 Bridge Surface

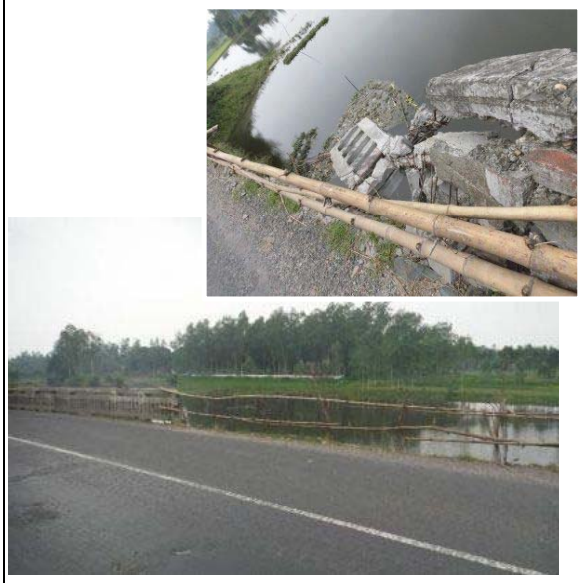


Photo 3 Missing of railing

Photo 4 Spalling/Rebar exposure of railing

Photo 5 Buried expansin joint

Photo 6 Buried expansin joint above Gerber-hinge

Summary and Recommendations

1. Observed Result

1) Among 10 bridges, representative 3 bridges (superstructure type; 2 RCC girder and a steel girder) are selected. Surveyed results for these bridges are summarized at P.3-8.

2) Regarding the rest of 7 bridges surveyed, the similar damages as that of the bridges reported, such as missing of railing (spalling of concrete, pavement crack/wearing above expansion joint, were found in some bridges.

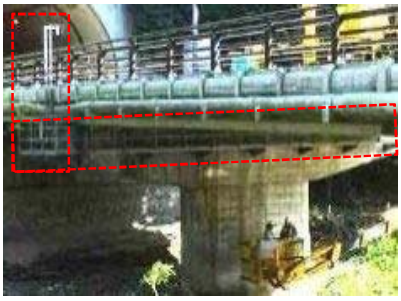
3) Loading capacity of brick masonry abutment must be limited.

4) Some bridges with narrow width were found. It is recommended that these bridges will be modified.

2. Remarks for implementation of bridge inspection in OJT

1) In bridge inspection, "Close" visual inspection is fundamental.
However, the close visual inspection for overall bridge structural elements without any access equipment was almost impossible due to limited or no access condition under the bridge in rainy season.

2) To inspect the whole components/elements by close visual inspection, it is recommended to install the inspection platform around bearings on piers and abutment, and vertical approach (ladders) to the top of piers, and using of boat if necessary.
It is desirable that installation of access equipment is considered at design stage.



Example:
Inspection Platform and Ladder

3) It is desirable that each inspection team will prepare GPS memory to identify the location of the bridge efficiently.

4) At the training of inspection at bridge site, it is recommended to implement traffic control such as temporary lane closure by traffic control personnel for frequent traffic passing and heavy traffic.

3. Acknowledgement

With the kind cooperation and guide by the staff of Sirajganj Division this survey was implemented successfully. We would like to express sincere thanks to all of them, especially to Mr. Azaad, Executive Engineer and his staff.

Photos

Sirajganj Sub-division Office

Visit to a Sub-Division Office

Heavy traffic passing

Mr. Azaad and his staff

Briefing by RHD staff

Talking of Team leader with RHD

Site survey of brick abutment

No side walk
(Insufficient width of shoulder)

The Report on the Site Visit
Conducted to Select Model Area for OJT

August 28, 2015

Bridge Management Capacity Development Project
JICA Consultant Team

Joint venture of
Japan Structure and Bridges Institute Inc. (JBSI)
Oriental Consultants Global Co., Ltd.. (OCG)
Japan Bridge Engineering Center (JBEC)

Table of contents

1. Purpose of Site Visit

Understanding of the JICA Team is that the Manikganj Division is the most suitable division for Model Area for OJT among Dhaka Zone from the viewpoint of (i) Number of bridges in the division, (ii) Traffic condition between the Base (RHD Training Center) and sites, and movement from a bridge to the next bridge, (iii) Possibility of communication disruption.
Purpose of the Site Visit is to confirm whether Manikganj Division is suitable for Model Area of OJTs from above point of view, mainly traffic condition from the Base to the area and the bridge to the next bridge.

2. Date of Site Visit

Time and Date: 9:30 ~ 20:00, 20 August, 2015

3. Participants

The Site Visit was carried out by following participants under the cooperation of the staff from the Manikganj Division Office.

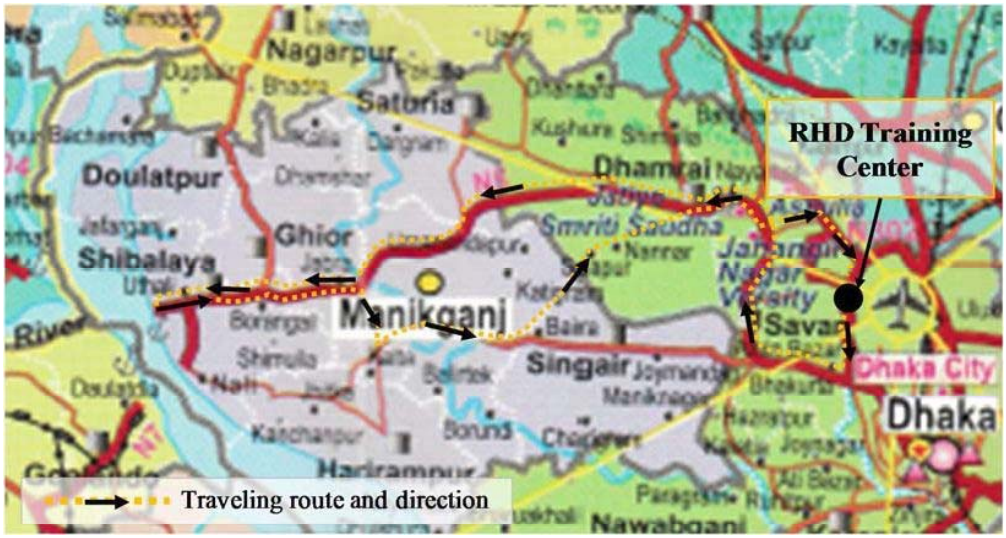
(1) The Manikganj Division Office
- Mr. Md. Mohibul Haque (EE of the Manikganj Office)
- Mr. Monirol Alam (AE of the Manikganj Division Office)
- Mr. Md. Shakhawat (WA of the Manikganj Office)

(2) The JICA Team
- Mr. Hiyama (Team Leader/Expert on Bridge maintenance management plan)
- Mr. Harazaki (Expert on Bridge inspection)
- Mr. Konishi (Expert on Bridge soundness evaluation)
- Mr. Iizuka (Expert on Bridge management plan)
- Mr. Hida (Expert on Detailed Survey)
- Mr. Kosaka (Expert on Bridge soundness evaluation/Bridge repair method)
- Mr. Makishima(Expert on Bridge maintenance management system)
- Mr. Yasashi (Project coordinator)
- Mr. Anis Sharif (Local coordinator)

4. Recognized roads and bridges

The Site visit was carried out on the roads shown in **Fig. 1.**
The JICA Team confirmed road traffic condition such as traffic jam, traffic volume, driving speed of vehicles; impact to traffic flow due to temporary parking near the bridges during inspection, and inspected the condition of approx. 14 bridges on the roads.

Fig. 1 Traveling route map



5. Confirmed facts

Following facts were confirmed through the Site Visit.

i. Traveling time between the Base and the site

Several traffic jam points were confirmed on the way between the Base and the site. However, it can be said that jam condition was not so serious because the JICA Team could pass all the jam sections within 10minutes. It took approx. 1 hour between the Base to the starting point of the NH5 section where Manikganj Division Office is managing. The Northern route was shorter than Southern route in traveling time.

ii. Traffic volume

Traffic volume was not so high on NH5 and RH was very small, therefore, any negative effects to bridge inspection works were not anticipated.

iii. Parking space

Vehicles for bridge inspection works can park near the bridges because of smaller traffic volume. It is expected that the inspection teams of OJT can find the parking space near the bridge easily.

iv. Possibility of communication disruption

The JICA Team could not find any large sized Industrial Park along the trip route. Almost the area along the trip route were farming area, therefore, it is expected that possibility of communication disruption will be very low.

6. Conclusion through the Site Visit

It can be concluded that Manikganj Division is the most suitable division for Model Area of Dhaka Zone from following points of view;

(i) Suitable number of bridges in the division (298 bridges).

(ii) Traffic condition between the Base and sites, and movement condition from a bridge to the next bridge were acceptable.

(iii) Parking space for the vehicle of the inspection team can be found near the bridge easily.

(iv) Possibility of communication disruption will be low.

Appendix

Photo 1

Explanation by Executive Engineer,
Manikganj Division

Photo 2

A bridge condition overview

Photo 3

Hearing to Executive Engineer
Related to bridge maintenance activities

Survey Report
on
Condition of Shahbazpur Bridge

March 8, 2018

BMCDP

Hiyama, Yoshimitsu

Konishi, Toshiyuki

Contents

1. Itinerary of Survey Trip

1.1 Place: Shahbazpur Bridge Site (Fig-1.1)

Fig.1-1 Location of Shahbazpur Bridge

1.2 Date: March 3rd (Saturday)

1.3 Participants:

RHD

Madam Rowshan Ara Khanam, ACE of BMW, RHD
Mr. Mohammad Yousuf, EE of Bridge Design Div.-2,RHD
Mr. Arun Alo Chakum, SE of Comilla Circle, Comilla Zone
Mr.Abu Ehtesham Rashed,EE of B.baria Div., Comilla Zone
Mr. Bhuiya Redwanur Rahman, SDE of B.baria Sub-Div., Comilla Zone
Mr. Md. Imdad Hossain, Ex. ACE of Barisal, RHD

JICA Consultant Team:

Mr. Yoshimitsu Hiyama, Team Leader
Mr.Toshiyuki Konishi, Bridge Evaluation
Mr.Asaduzzaman, Local Bridge Engineer

1.4 Itinerary

7:30 Departure from Six Seasons Hotel
10:00 Arrival at Shahbazpur Bridge Site
10:00 - 12:00 Bridge Survey
12:00 - 14:00 Lunch and Meeting
14:00 Departure from Brahmanbaria
16:30 Arrival at Dhaka

2. Preliminary Survey

2.1 Basic Data of Shahbazpur Bridge

Basic data of Shahbazpur Bridge is shown as Table 2-1.

Table 2-1 Basic Data of Shahbazpur Bridge

File Number	N2- LRP093a-20180227						Date			27-Feb-18
Zone	Comilla		Circle	Comilla	Division	Brahmanbaria	Sub-Division	Brahmanbaria	SO	SO-4
District	Brahmanbaria		Upazila	-	Union	-		Village		-
Road No.	N2	Road Name	Dhaka-Bhairab-Jagadishpur-Sylhet-Tamabil-Jaflong			LRP Name	LRP093a	GPS	Lat	24Â° 2â€² 47â€³
									Long	90Â° 10â€² 38â€³
Bridge Name	**Shahbazpur Bridge**			LRP+Offset	-			Chainage		92.673 (m)
Year of Construction	1965	Design Standard		-			Design Load	-	Load Restriction	-
Public Utilities Carried	-			-						
Bridge Length	203.75 (m)	No. of Spans	9	Span Arrangeme	7.5+18.3+25.45+28.45+39.75+34.3+23.9+18.5+7.6			Skew Angle		-
		Type		Material			Type		Material	
Superstructure	Bridge Type	RC Girder Bridge		Concrete		Deck Slab	-		-	
Substructure	Abutment	Unknown		-		Foundation (Abutment)	Unknown		-	
	Pier	Column Type		-		Foundation (Pier)	Unknown		-	
Other Elements	Pavement	Asphalt		-		Bearings	-		-	
	Expansion Joint	-		-		Railing	-		-	
Width	Total Width	10.63 (m)	Curb-L	Sidewalk-L	Carriage way-L	Median		Carriage way-R	Sidewalk-R	Curb-R
	Effective Width	8.09 (m)	0.73 (m)	0.58 (m)	6.63 (m)	-		-	0.58 (m)	0.73 (m)
Traffic Conditions		Census (Year)		-			Condition Category for Entire Bridge		-	-
		Traffic Volume		15,000 to 20,000 Vehicles						

2.2 Results of Preliminary Survey

Preliminary survey was carried out on 26th of November, 2017 by RHD project officials and a local bridge engineer of JICA consultant team. The report is attached in Appendix-1.

3. Results of Survey

3.1 Conditions and Characteristics of Defects

The defects are mainly as follows. (Refer to Fig.3-1)

1) P1-P2 Fallen-out of deck slab concrete

2) P1-P2 Shear force cracks on main girders

3) P4-P5 Mending moment cracks on main girders

4) P2-P3、P4-P5、P6-P7　Abnormal space, gap and vibration at hinge parts

The conditions and characteristics are as follows.

1) P1-P2 Fallen-out of Deck Slab Concrete（Fig.3-2）

*The concrete slabs on the line where many heavy vehicles are running are damaged.

*Falling-out of slab is occurring at two points and two-direction cracks are progressing toward fallen-out at a point.

*The slabs other than P1-P2 are not so damaged yet.

2) P1-P2 Shear Force Cracks on Main Girders Fig.3-3）

*The shear force cracks which can be confirmed by distant view are taking place on the girder webs near P1 bearing and P2 bearing.

These cracks are penetrating the girder webs because the cracks exists on the both sides of the webs.

There are no free limes and rust fluid from the cracks.

The re-bars at the points of honey combs and delamination are rusting and concrete covers on re-bars are also very thin.

The cracks are occurring near all girder ends (three girders therefore six ends) and especially the crack width of G1 girder near P1 is large. However, main girders between P6-P7 are not damaged although the structure is same as the girders between P1-P2.

3) P4-P5 Bending Moment Cracks on Main Girders Fig.3-4）

Bending moment cracks which can be confirmed by distant view are taking place around the center of span.

There are no free limes and rust fluid from the cracks.

The re-bars in delaminated area are rusting and their concrete covers are thin.

The cracks are taking place on all the girders and their damage levels are almost same.

4) P2-P3、P4-P5、P6-P7　Gerber Hinge Parts (Fig.3-5)

Abnormal spaces, gaps and vibrations were observed at gerber hinge parts. Regarding abnormal spaces, the space of one side of the birders is around 50mm and the supporting girders are largely separate from suspension girders while that of opposite side is almost none. Gaps with 20-30 mm in vertical and horizontal direction are produced between the railing of supporting girders and that of suspension girders. This makes imagine that the suspension girders may be inclined. The vibration of suspension girders are severe.

3.2 Estimation on Causes of Defects

1) P1-P2 Fallen-out of Deck Slab Concrete

The causes are fatigue fracture due to running vehicles. Furthermore, the slab thickness with 125 mm was not enough to bear traffic loading.

The progress of damage is fast at ponding area but the reason why the damages are occurring only between P1 and P2 is not clear.

2) P1-P2 Shear Force Cracks on Main Girders

It seems that the cracks are caused by insufficient load bearing capacity due to due to low girder height.

The reason why the crack width of G1 girder near P1 is especially large is not clear. Since the rigidity of deck slab between G2 girder and G3 girder decreased due to the fallen-out of deck slab concrete, the burden onto G1 girder might have increased. The honey combs due to improper construction on G1 girder near P1 might have been a trigger of cracks.

The reason why the defects are taking place only between P1 and P2 is not clear. Since the thickness of concrete is thin, the influence of carbonization should be considered.

3) P4-P5 Bending Moment Cracks on Main Girders

The cracks might be caused by that the girder height is not enough for the load carrying capacity.

4) P2-P3、P4-P5、P6-P7　Gerber Hinge Parts

It can be estimated that the cracks and spalling of concrete, abnormal spacing and gaps, and abnormal vibration are occurring due to the defects of anchorage.

As the damages at gerber hinge parts might lead to bridge collapse, urgent countermeasures would be required.

4. Advices for Remedial Measures

1) P1-P2 Falling-out of Deck Slab Concrete

As urgent countermeasures, the place of steel plate which are now executed is common.

Permanent countermeasures to increase load carrying capacity are as follows.ろ。

- To increase the thickness of deck slab.
- To bond carbon fiber sheet on the bottom surface of slab.
- To bond steel plate on the bottom surface of slab.

According to Japanese specification, the slab thickness of this bridge is calculated 230 mm. Compared to that, actual thickness of this bridge, 125ｍｍ is too thin.

As the increase of slab thickness caused the increase of dead loads, it influences the capacity of other elements.

The bonding of carbon fiber might exceed the limit of bonding thickness to secure slab rigidity.

Therefore, steel plate bonding methods are recommended. However, the part of deck slab which are already fallen out should first be reconstructed.

2) P1-P2 Shear Force Cracks on Main Girders

As the emergency countermeasures, temporary steel support or sand bag support is proper to reduce cracks.

Permanent countermeasures are as follows.

- To increase main girder section.
- To bond carbon fiber sheets.
- To bond steel plates.

As the cracks which are now occurring are large in width, significant increase of capacity is required.

The increase of girder section requires traffic control until the concrete hardens. Furthermore, dead load largely increases.

The bonding of carbon fiber can’t expect sufficient capacity increase as the increase of section rigidity is small.

Therefore, steel plate bonding method is recommended.

3) P4-P5 Bending Moment Cracks on Main Girders

The temporary countermeasure using Bailey bridge is now applied to control cracks. As other countermeasures, the method by temporary steel pipe support can be applied.

As permanent countermeasures, steel plate bonding can be recommended as well as 2).

4) P2-P3、P4-P5、P6-P7　Gerber Hinge Parts

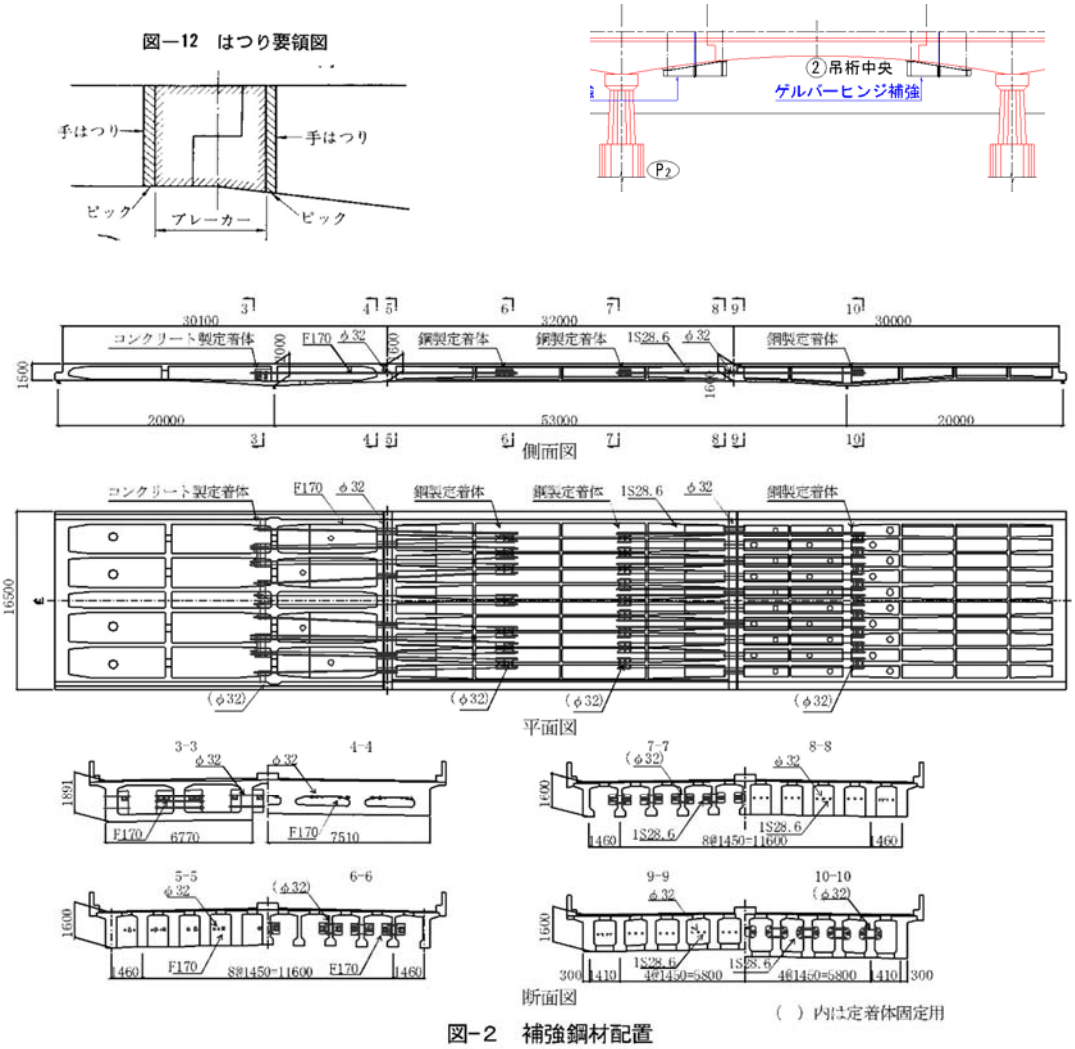
In order to prevent suspension girders from falling down, temporary countermeasures such as supporting suspension girders on temporary bents (steel posts) or placing Bailey bridge on suspension girders are applied.

In case of Shahbazpur Bridge, three Bailey bridges are to be placed on three Gerber parts. This leads to the worsening of traficability. Furthermore, long time traffic control to place Bailey bridges are required.

Therefore, the method to support Gerber parts by temporary bents is recommended.

Permanent countermeasures are as follows.

- To support Gerber hinge parts by newly constructed piers.
- To break Gerber hinge parts and to make new Gerber hinge parts.
- To set steel devices for strengthening on the bottom of Gerber hinge parts.
- To unite Gerber hinge parts by concrete filling and PC tendons.



図－2　補強鋼材配置

5. Detailed Investigation for Strengthening Design

The information required for strengthening design is as follows.

1） Basic Conditions

- Design year
- Applied standard and design load
- Design drawing, bar arrangement drawing
- Construction year
- Repair records

2） Slab

- Slab thickness

・Bar arrangement

3） Main Girders

・Girder height

・Girder width

・Bar arrangement

・Concrete cover thickness

・Carbonization

4） Gerber Hinge Parts

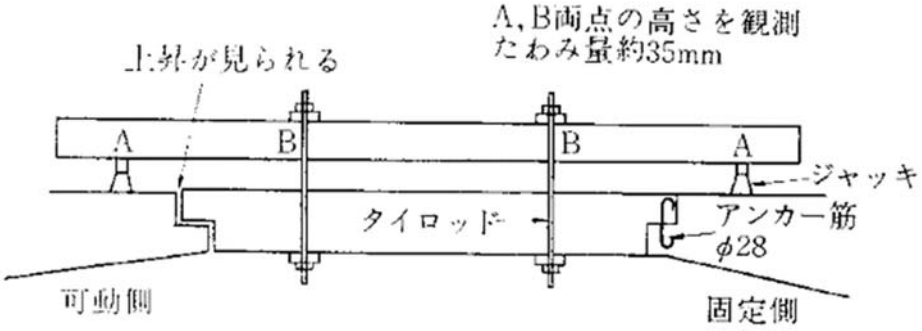
・Damage conditions such as cracks

・Structural size

・Bar arrangement

・Anchorage bar

The confirmation of hinge parts becomes large scale as following figure.

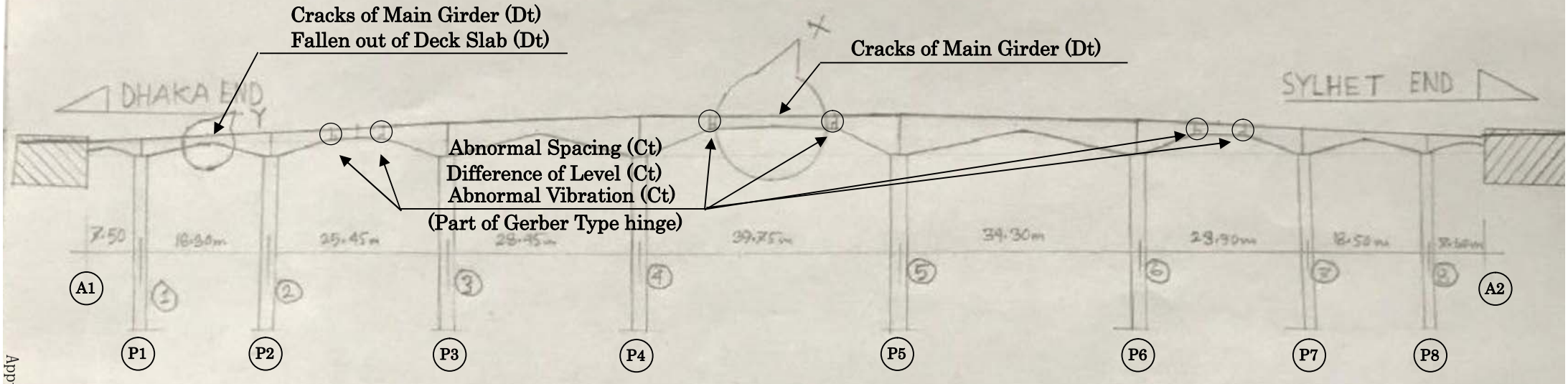


5） Structural Change

・Fixation of girder ends

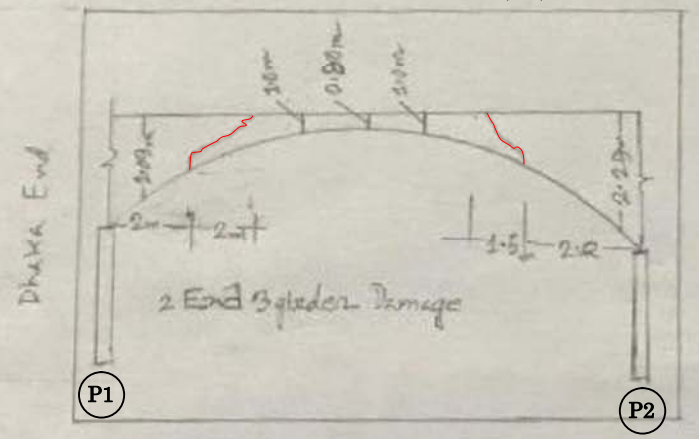
・Malfunction of bearings

Shahbazpur Bridge



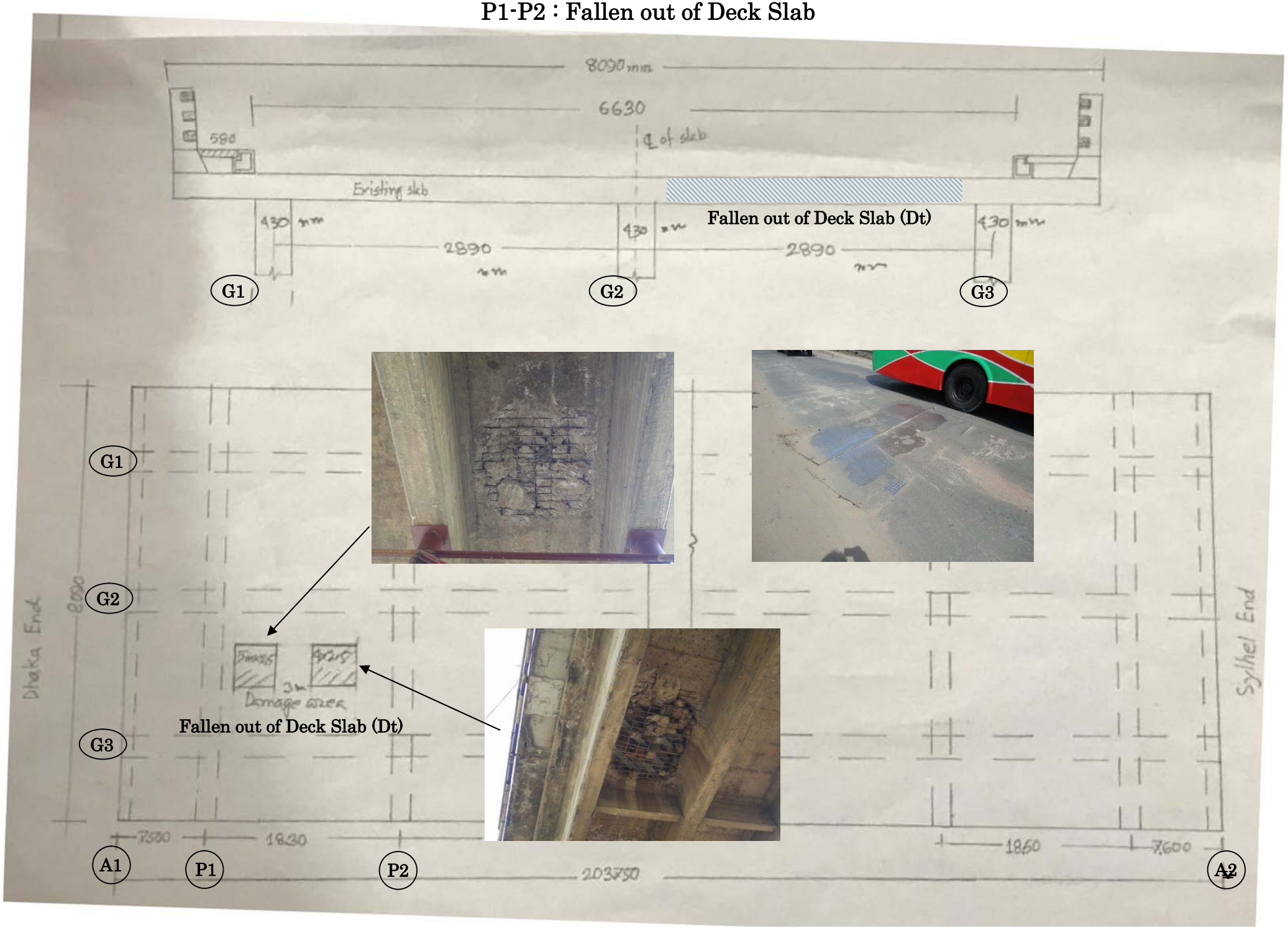
Note:
1) Length of Bridge = 203.75m
2) Bridge width = 8.090m
3) No of Span = 9 Nos
4) Girder width = 0.430m
5) Nos of girder in Each Span = 3 Nos.
6) Suspended girder Span = 3 Nos.

Cracks of Main Girder (Dt)



Section – Y

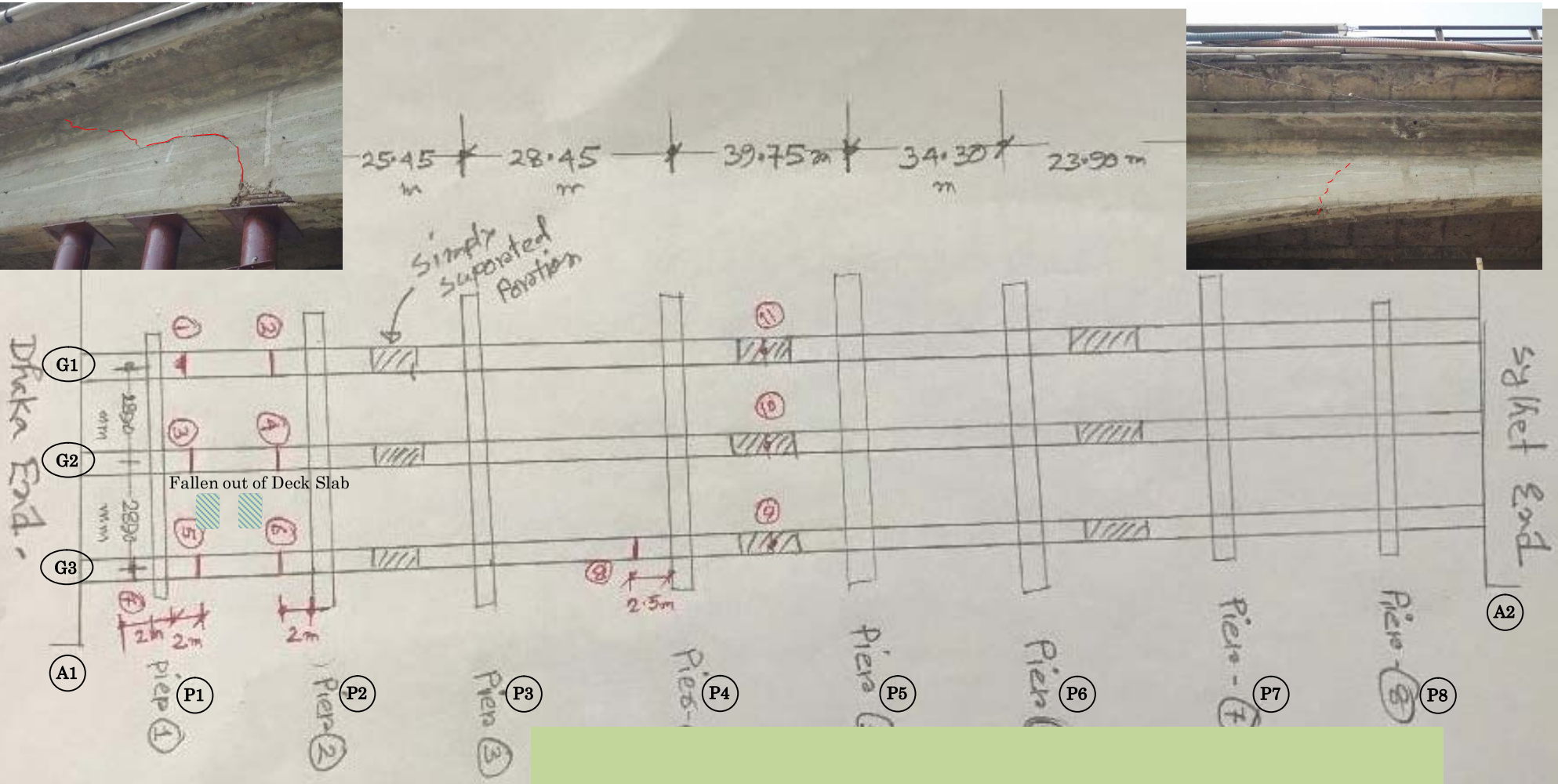
P1-P2 : Fallen out of Deck Slab



P1-P2 : Cracks of Main Girder

① G1 : Cracks of Main Girder

② G1 : Cracks of Main Girder



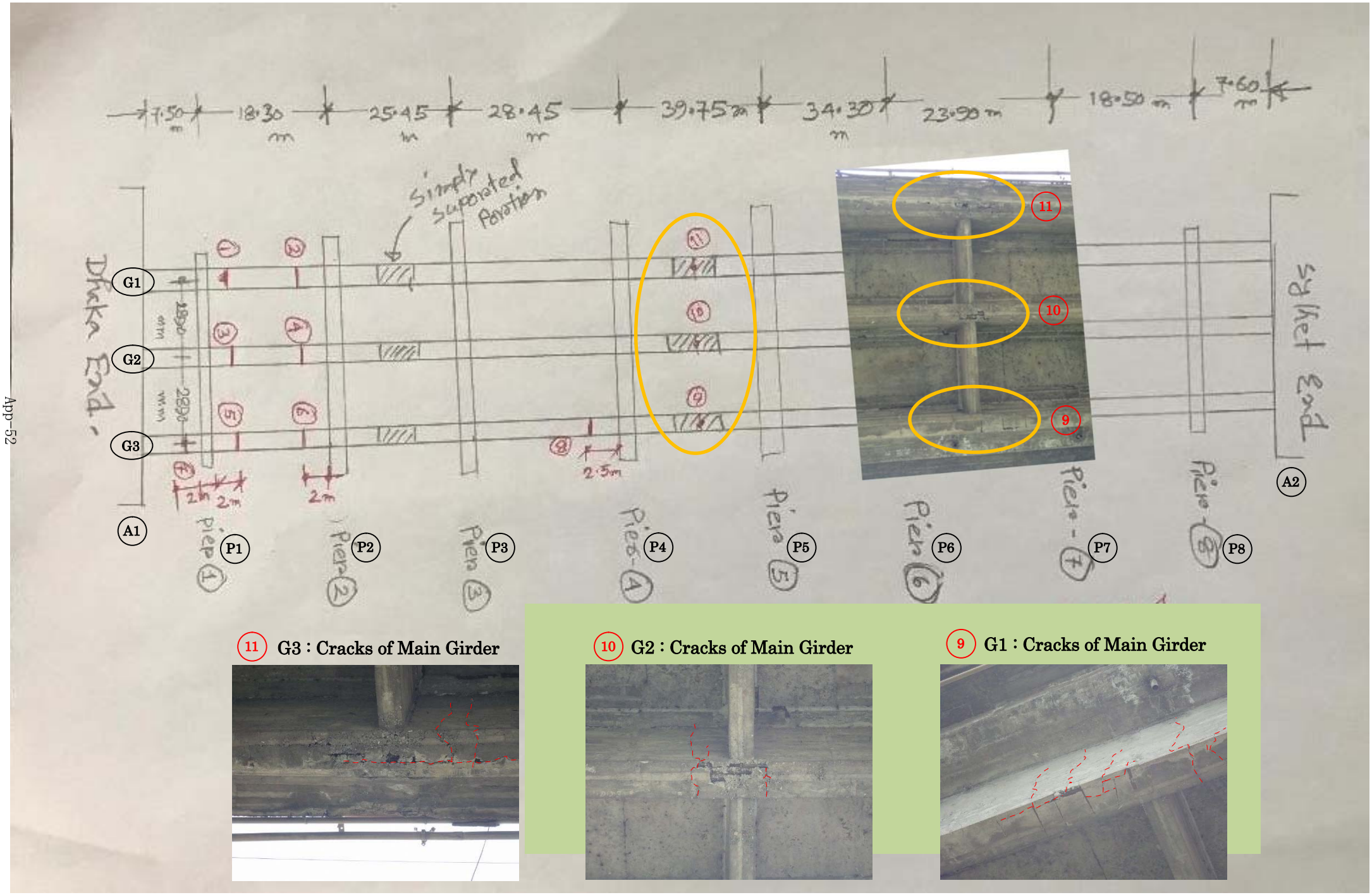
⑦ G3 : Cracks of Main Girder

③ G2 : Cracks of Main Girder

⑤ G3 : Cracks of Main Girder

⑥ G3 : Cracks of Main Girder

P4-P5 : Cracks of Main Girder

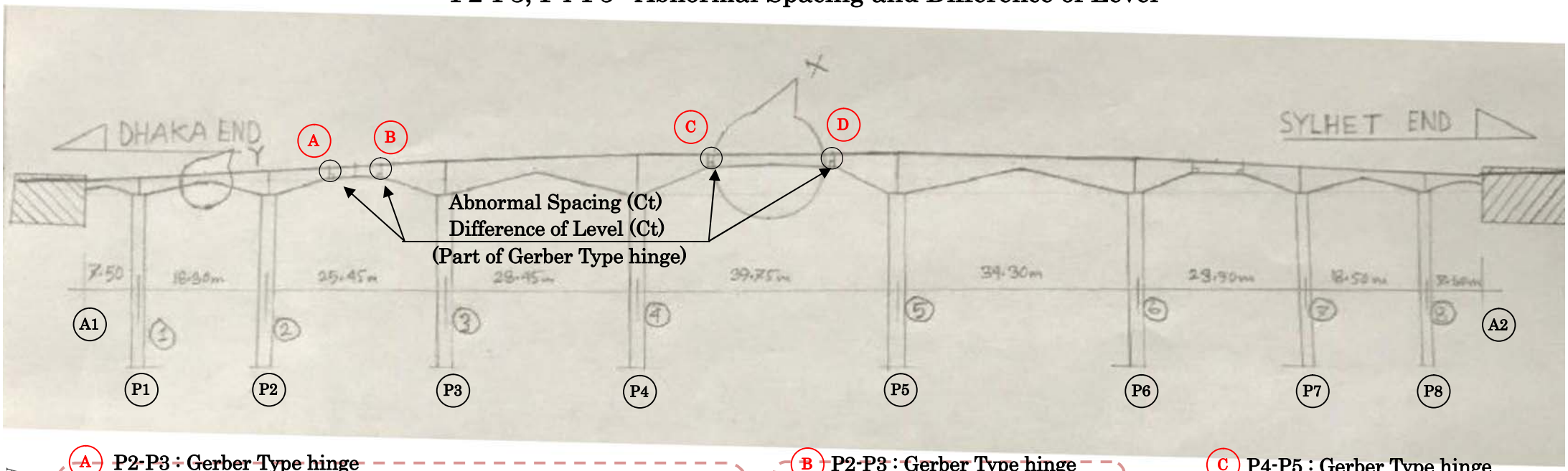


11 G3 : Cracks of Main Girder

10 G2 : Cracks of Main Girder

9 G1 : Cracks of Main Girder

P2-P3, P4-P5 : Abnormal Spacing and Difference of Level



A P2-P3 : Gerber Type hinge

Difference of Level (Ct)

Abnormal Spacing (50mm:Ct)

B P2-P3 : Gerber Type hinge

Abnormal Spacing (≒0mm:Ct)

Difference of Level (25mm:Ct)

C P4-P5 : Gerber Type hinge

Abnormal Spacing (?0mm:Ct)

D P4-P5 : Gerber Type hinge

Abnormal Spacing (≒0mm:Ct)

Survey Report
on
Condition of Damdama Bridge

March 13, 2018

BMCDP

Hiyama, Yoshimitsu

Konishi, Toshiyuki

Contents

1. Itinerary of Survey Trip

1.1 Place: Damdama Bridge Site (Refer Fig.1-1)

The location of Damdama Bridge is shown in Fig.1-1.

Fig.1-1 Location of Damdama Bridge

1.2 Date: March 6th (Tuesday)

1.3 Participants:

RHD:

Madam Rowshan Ara Khanam, ACE, BMW, RHD

Mr. Najmul Hasan, EE, Bridge Design Div.-1, BMW, RHD

Mr.Samusudin Ahmed, EE, Planning & Design Div., BMW, RHD

Mr. Md. Mahbubul Alam Khan, SE, Rangpur Circle, Rangpur Zone, RHD

Mr. Md. Shezedur Rahman, EE, Rangpur Div., Rangpur Circle, Rangpur Zone, RHD

Mr. Md. Firoz Akter, SDE, Rangpur-1 Sub-Div., Rangpur Div., Rangpur Circle, Rangpur Zone, RHD

JICA Consultant:

Mr.Yoshimitsu Hiyama, Team Leader, JICA Consultant Team, BMCDP

Mr.Toshiyuki Konishi, Evaluation Expert, JICA Consultant Team, BMCDP

Mr.Abudullah Al Mamun, Bridge Engineer, JICA Consultant Team, BMCDP

1.4Itinerary:

7:00 Start from Six Seasons Hotel

9:00 Departure from Shah Jalal Airport (US Bangla BS151)

10:00 Arrival at Saidpur Airport

11:00 Arrival at Damdama Bridge Site

11:00 - 12:30 Bridge Inspection

13:00 – 15:30 Lunch and Meeting

18:00 Departure from Saidpur Airport (US Bangla BS156)

18:45 Arrival at Shah Jalal Airport

19:30 Arrive at Six Seasons Hotel

2. Preliminary Survey

2.1 Basic Data of Damdama Bridge

Basic data of Damdama bridge is shown as Table 2-1.

Table 2-1 Basic Data of Damdama Bridge

File Number	N5-319a-20180304						Date	4-Mar-18		
Zone	Rangpur		Circle	Rangpur	Division	Rangpur	Sub-Division	Rangpur	SO	SO-5
District	-		Upazila	-	Union	-		Village		-
Road No.	N5	Road Name	Dhaka -Paturia-Kashinathpur- Bogra-Rangpur-Beldanga- Banglabandha Road			LRP Name	319a	GPS	Lat	25° 40' 45"
									Long	89° 16' 26"
Bridge Name	**Damdama Bridge**			LRP+Offset	618 (m)			Chainage		317.089 (m)
Year of Construction	1982	Design Standard		Others			Design Load	-	Load Restriction	-
Public Utilities Carried	-			-						
Bridge Length	60.70 (m)	No. of Spans	3	Span Arrangement	18+24+18			Skew Angle		-
		Type		Material			Type		Material	
Superstructure	Bridge Type	RC Girder Bridge		Concrete		Deck Slab	-		-	
Substructure	Abutment	Unknown		-		Foundation (Abutment)	Unknown		-	
	Pier	Unknown		-		Foundation (Pier)	Unknown		-	
Other Elements	Pavement	Asphalt		-		Bearings	-		-	
	Expansion Joint	-		-		Railing	-		-	
Width	Total Width	8.30 (m)	Curb-L	Sidewalk-L	Carriage way-L	Median		Carriage way-R	Sidewalk-R	Curb-R
	Effective Width	6.70 (m)	-	-	-	-		-	-	-
Traffic Conditions		Census (Year)		-			Condition Category for Entire Bridge		-	-
		Traffic Volume		10,000 to 15,000 Vehicles						

2.2 Results of Preliminary Survey

Preliminary survey of Damdama Bridge was carried out by Rangpur Division, RHD.

The results of survey are shown by the following figure and photos.

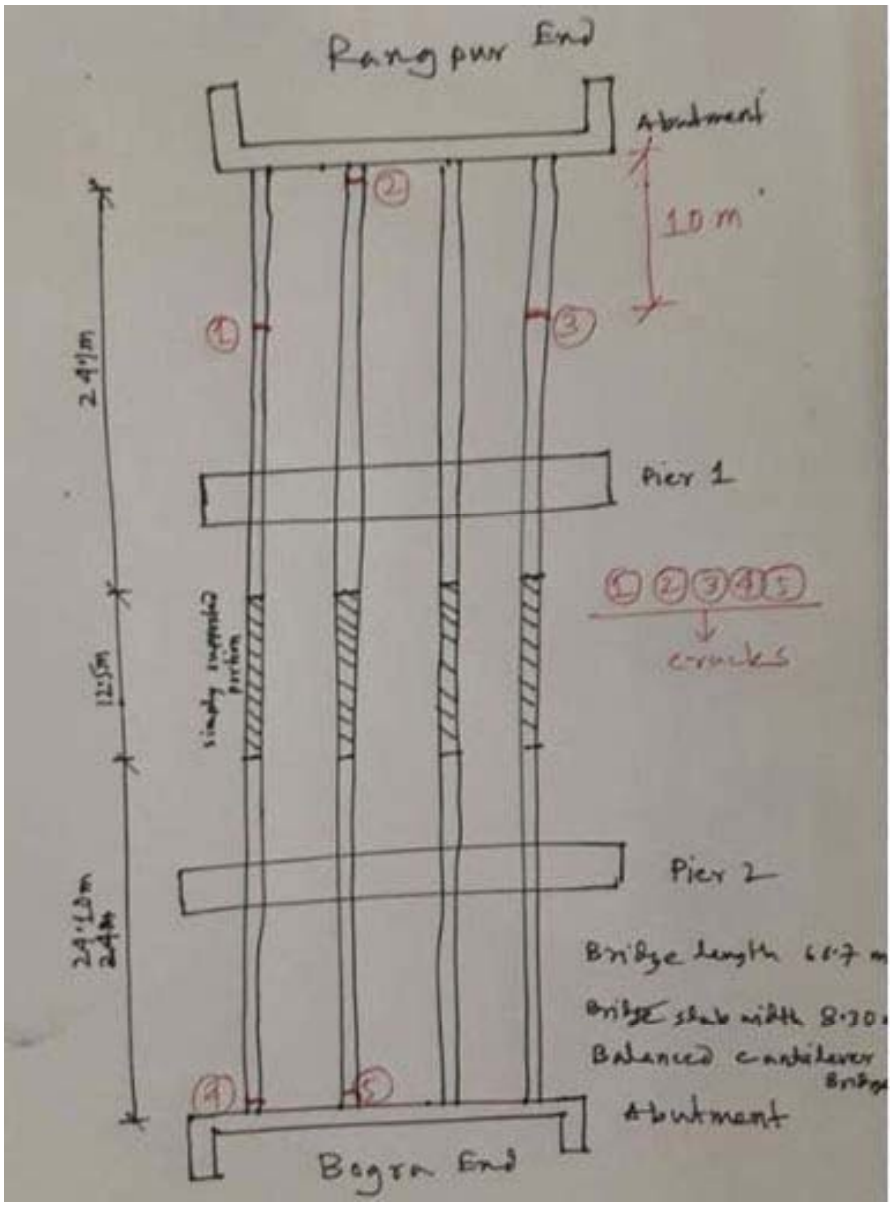


Fig.2-1 Position of Damages

Photo 2-1 Position of Crack-1

Photo 2-2 Position of Crack-2

Photo 2-3 Position of Crack-3

Photo 2-4 Position of Crack-1 to Crack-3

3. Results of Survey

3.1 Conditions and Characteristics of Defects

The defects are mainly following two types. (Fig.3-1）

1) Shear force cracks on main girders near A1 support and A2 support.
2) Bending moment cracks around span center between A1 abutment and P1 pier.

The conditions and characteristics of defects are as follows.

1) Shear force cracks on main girders near A1 support and A2 support (Fig.3-2）

Shear force cracks occurring on G3 girder and G4 girder near A2 support. They can be confirmed even by distant view.
The crack width is 1.7 mm on G4 girder and 1.3 mm on G3 girder.
These cracks are perforate cracks because the cracks are produced at the same position on both sides of the girder.
No free lime and no rusting fluid from the cracks can be seen.
G4 girder end is touching with the parapet of abutment.

On the other hand, shear force cracks are occurring only on G3 girder near A1 support. The cracks are perforate. No free lime and rusting fluid can be observed.
The lower part of G4 girder is touching with the parapet of abutment.

2) Bending moment cracks around span center between A1 abutment and P1pier (Fig.3-3）

Some bending moment cracks are taking place around span center on outside girders G1 and G4. They can be observed even by distant view. Two lines of cracks on G1 girder and 7 lines of cracks on G4 girder can be seen.
On the other hand, there are no cracks between P2 pier and A2 abutment.

3.2 Estimation on Causes of Defects

1) Shear Force Cracks near A1 Support and A2 Support

It is estimated that the stresses exceeding shear capacity are acting on the girder section. Shear reinforcement might be insufficient around girder end.

The crack width of G4 girder is wider than that of G3 girder at A2 side. It seems that first, the shear crack took place on G4 girder. And next, due to the stress release following cracks, the burden of G3 girder increased and the cracks of G3 girder were caused.

As the occurrences of stress are complicated near end support, the touch of girder with abutment might have given influence to stress occurrences and have led to the cracks.

Furthermore, the malfunction of roller bearings at intermediate support might have also given influence to the progress of cracks.

In future, the cracks may spread to no damaged girders.

2) A1-P1 Bending Moment Cracks on Main Girders

It seems that the cracks were caused by insufficient bearing moment capacity against acting loads.

The cracks are occurring only on outer girders. It seems that this is because outer girders are bearing more loads than inner girders and the amount of re-bars of outer girders are not relatively enough considering the dead loads of cantilever slab.

There's also possibility that the mal function of roller bearings on intermediate support contributed to the progress of cracks.

G4 girder seems to have been repaired previously but the cracks have occurred again. The amount of reinforcement may not be sufficient. However, as the cracks haven't spread to inner girders yet, the possibility that the cracks of outer girders will immediately develop will not be large under current loading conditions.

Further, the reason why there are no cracks on outer girders in other spans can't be explained clearly.

4. Advices for Remedial Measures

1) Shear Force Cracks on Main Girders near A1 and A2 Support

It can be judged that the risk of collapse would not so high because not so wide cracks only exist on one or two girders out of four girders.

It is appropriate to apply temporary bents (vertical steel pipe support) or sand bags as immediate countermeasures to control cracks.

As permanent countermeasures, first, to secure the space between girders and abutment and to recover the function of bearings are required.

Furthermore, the methods like the followings are to be applied to strengthen the load carrying capacity of girders.

・To thicken girder section.

・To bond carbon fiber sheets.

・To bond steel plates.

It is recommended that in case of small excess of stress, carbon fiber sheet bonding is to be applied and in case of large excess amount of stress, steel plate bonding is to be applied under current loading condition.

In either case, strengthening measures are to be carried out after current crack repair. As the crack width is more than 0.5 mm, the concrete is cut in U-shape along crack line and filling materials are injected into cracks.

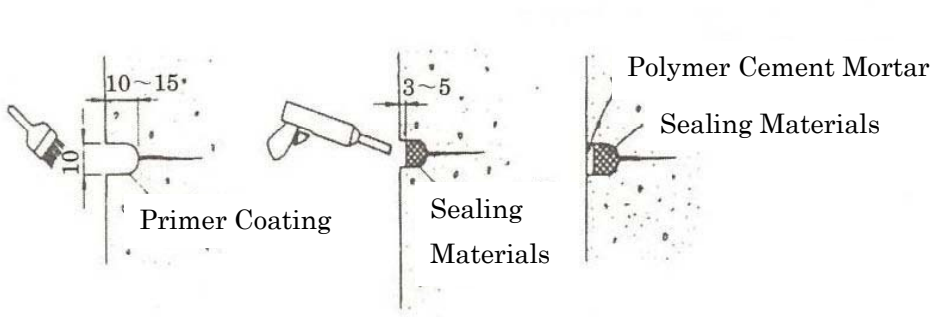


Fig.4-1 Filling Method

2) A1-P1 Bending Moment Cracks on Main Girders

It seems that the risk of collapse would not so high because the cracks are occurring only on outer girders. It is proper to apply temporary bents or sand bag support as immediate countermeasures to control cracks.

Permanent countermeasures are same as **1).**

5. Detailed Investigation for strengthening

The information required to strengthening design is as follows.

1) Basic Conditions

- Design Year
- Applied Specification and Design Load
- Design Drawings and Bar Arrangement
- Construction Year
- Repair Records

2) Main Girder

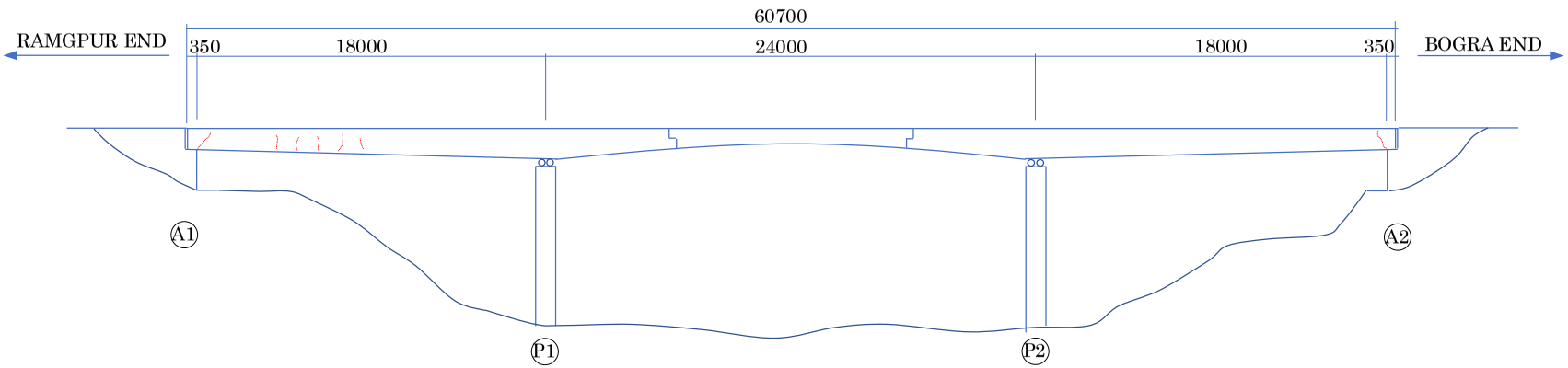
- Girder Height
- Girder Width
- Bar Arrangement
- Concrete Cover Thickness
- Depth of Carbonization

3) Structural Change

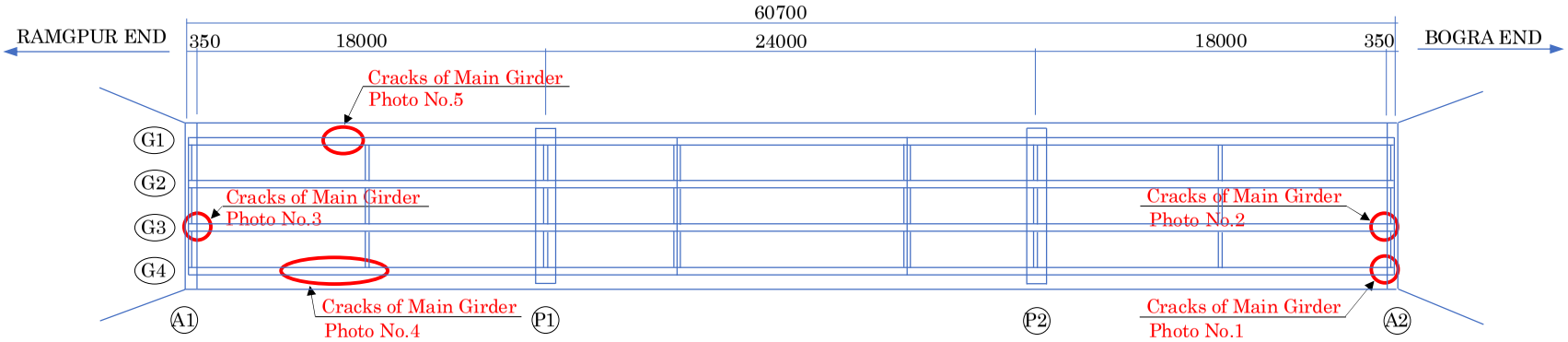
- Fixation of Girder End
- Mal Function of Bearing

DAMDAMA BRIDGE GENERAL VIEW

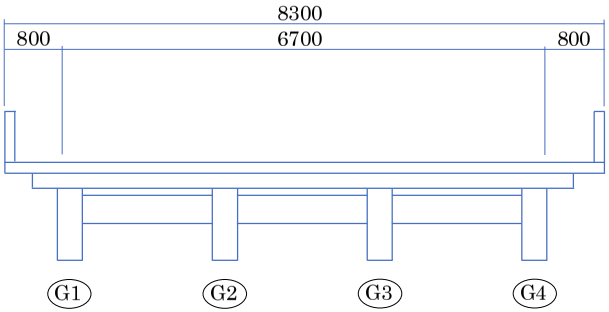
SIDE VIEW



PLAN



CROSS SECTION



SIDE VIEW

FRONT VIEW

Shear Cracks of main Girder

Photo No.3 A1-P1 G3 : Shear Cracks of main Girder

Photo No.2 P2-A2 G3 : Shear Cracks of main Girder

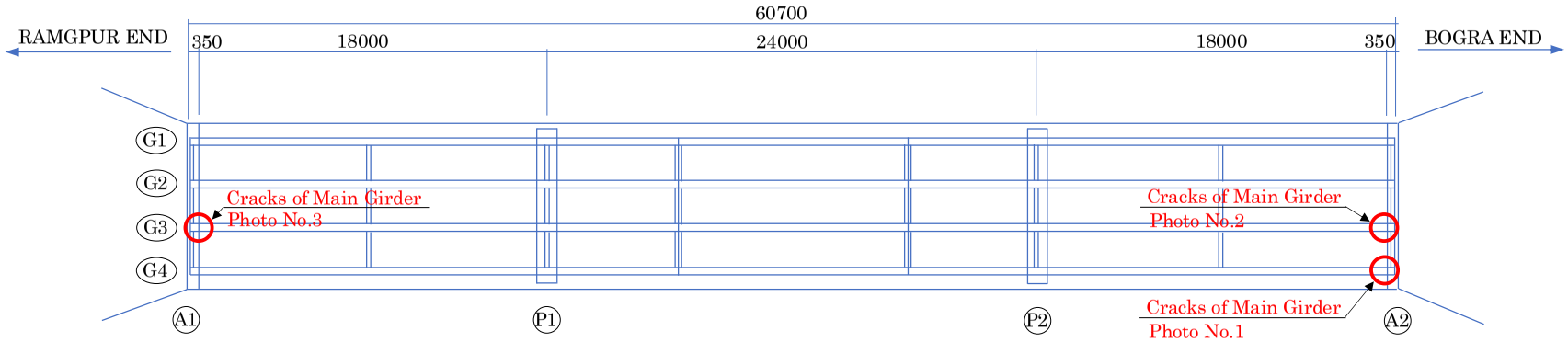


Photo No.1 P2-A2 G4 : Shear Cracks of main Girder

Flexural Cracks of main Girder

Photo No.5　A1-P1 G1 : Flexural Cracks of main Girder

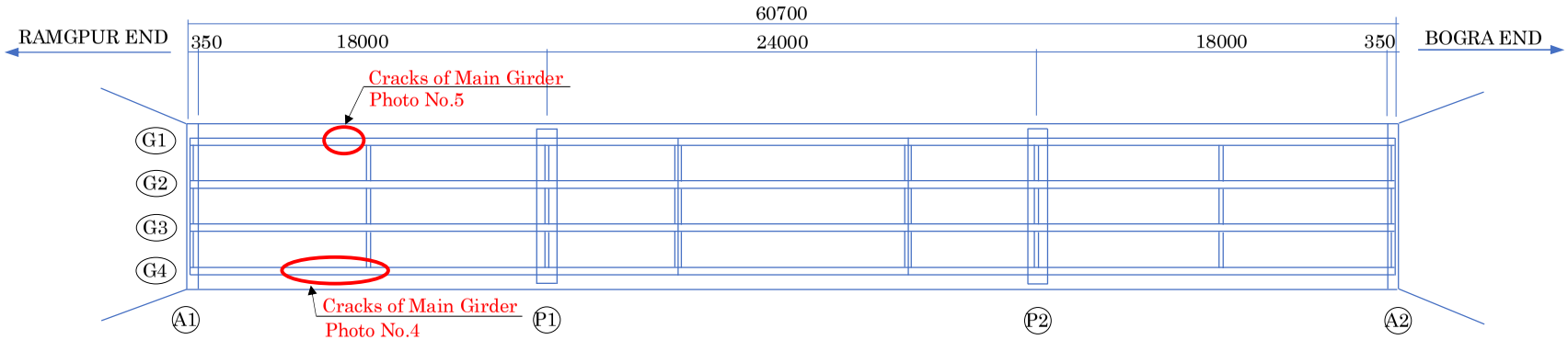


Photo No.4　A1-P1 G4 : Flexural Cracks of main Girder

Report on
Site Survey of Nolka Bridge
along N-405 in Sirajganj Division

19 April 2018

- JICA Project Team

Outline

1. Purpose
   a) To understand the present situation of this bridge.
2. Date: 05 April, 2018
3. Attendants:
   - Mr. Abdullah Al Mamun, Bridge Engineer, JICA Consultant Team.
   - Mr. Md. Asaduzzaman, Bridge Engineer, JICA Consultant Team.
   - Mr. Abul Kalam Mahmmad Zahurul Alam Khan, SDE, Sirajganj Sub-division-2, RHD

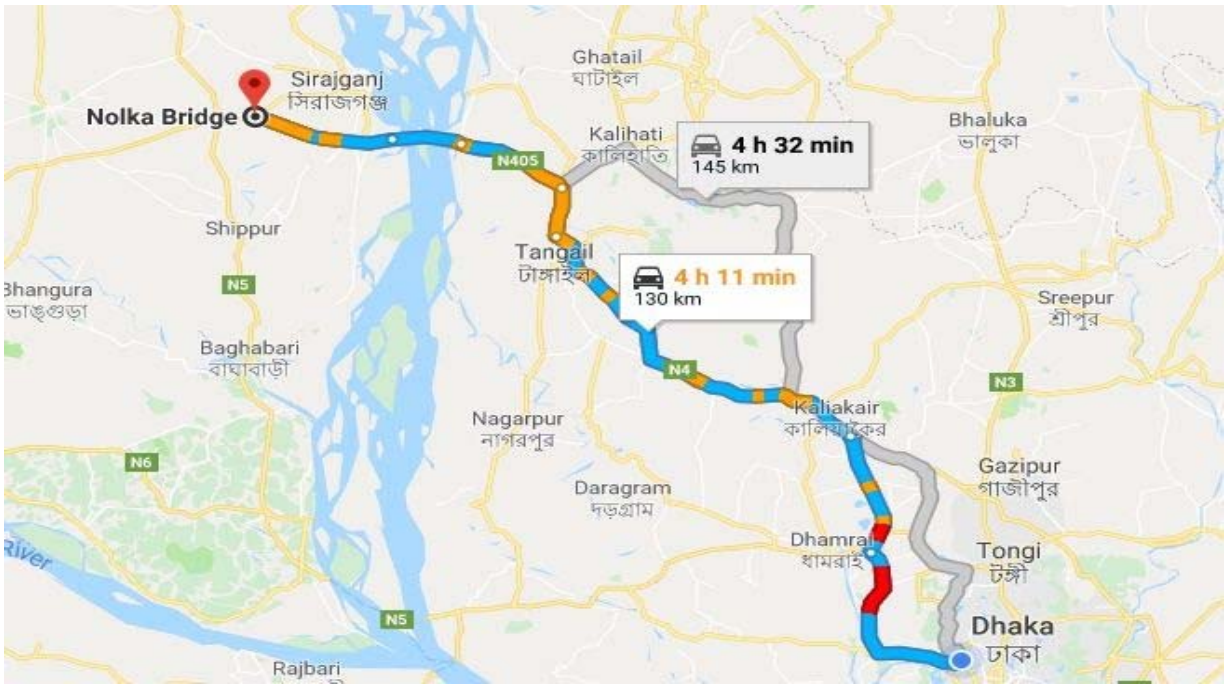


Figure : Location of Nolka Bridge

Basic Bridge Information

Structure Name	Nolka Bridge
Zone	Rajshahi
Circle	Pabna
Division	Sirajganj
Sub-Division	Sirajganj-2
Road No.	N-405
Road Name	Elenga-Nalka-Hatikamrul Road
Chainage	36.629 Km
Structure ID	
Structure No	
Location	Lat: 24.423233, Long: 89.592267
Year of Construction	1988

Structural Information

Bridge Type	RC Girder (2 end span) + PC Girder (6 middle spans)
Bridge Length (m)	236.4
Bridge width (m)	9.6
Effective Width (m)	7.3
No. of span	8
Suspended Span No.	-
No. of girder in each Span	5
Girder Width (m)	--
Distance between girders (m)	--
Large vehicles rate per 20	--

Summary of Deficiencies

Element	Deficiencies
Approaches	Severe Pothole (Photo 2)
Guide Posts	----------
Slope Protection	----------
Toe Wall	----------
Railing	----------
Side Walk	----------
Deck	----------
Concrete Beam	Spalling & Exposed Rebar exist (Photo 7) Crack & Spalling at Girder end exist (Photo 6 & 8)
Steel Beam	----------
Truss	----------
Pavement	Rutting & Wave (Photo 3) Pothole (Photo 5)
Abutment	----------
Pier	----------
Wing Wall	----------
Pier Cap	----------
Bearing Seat	----------
Bearing	----------
Expansion Joint	2 Feet wide T-shaped Steel plate is used as expansion joint. The connection is loose & sometimes misaligned & abnormal noise is present because of that. (Photo 4)
Pile Cap	----------
Foundation Protection	----------

Comments:

The bridge has moderate to heavy vibration in both horizontal & vertical axis. Severe Crack exist at the Girder end (Photo 8), so that RHD has put temporary Support to the damaged Girder (Photo 6).

Photo

Photo 1: Side View (Dhaka End)

Photo 2: Back View (Rajshahi End)

Photo 3: Rutting & wave on Bridge Pavement

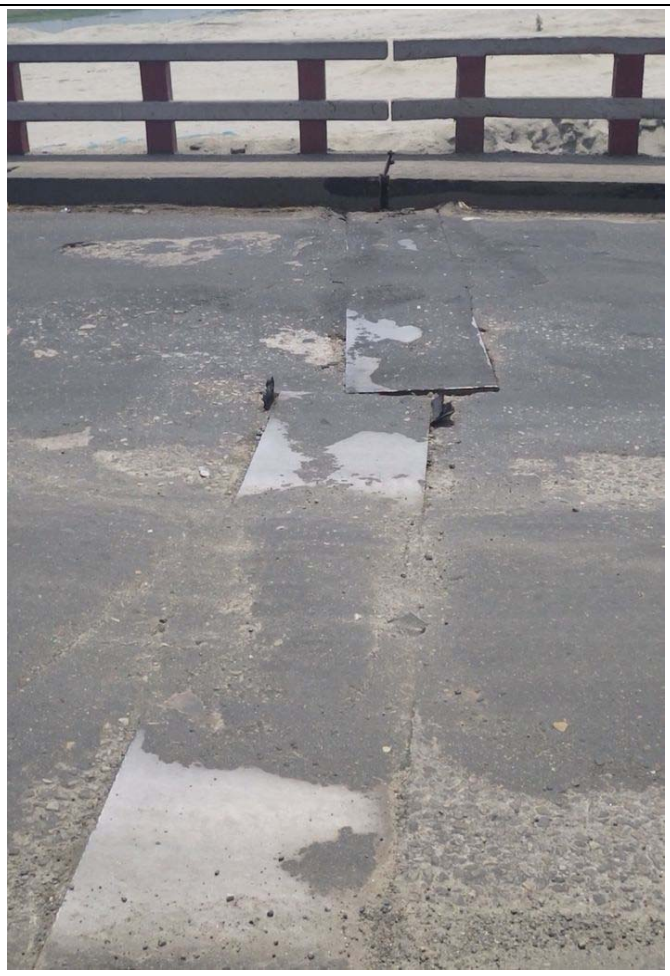


Photo 4: Damaged Expansion Joint (2 feet wide T-shaped steel plate is used as expansion joint all through the bridge)

Photo 5: Pothole near expansion joint

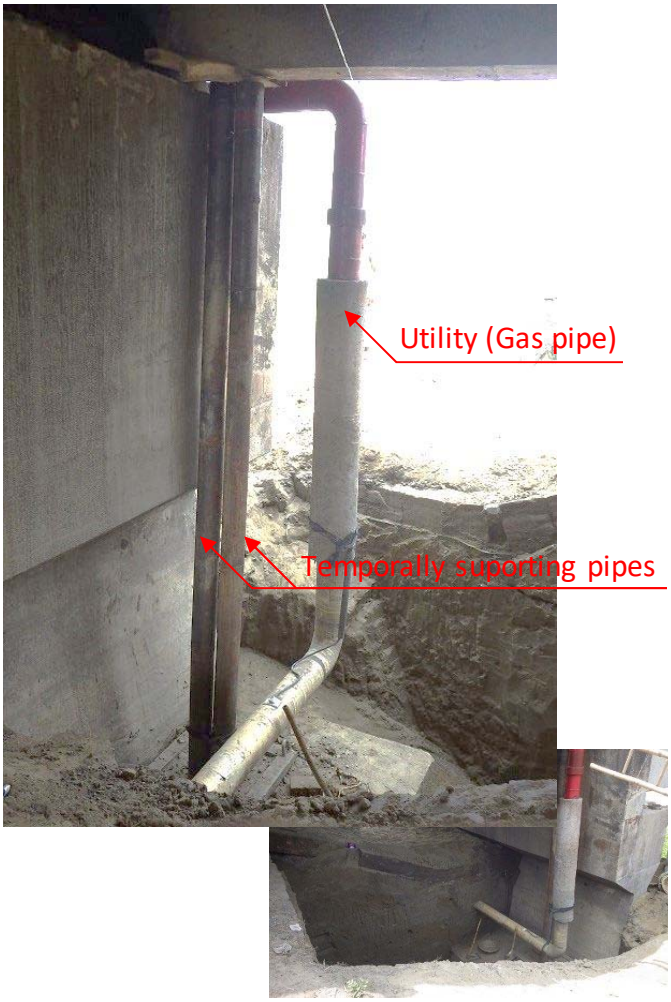


Photo 6: Temporary Support on the damaged Girder & excavation to build brick support (P1, Dhaka side)

Photo 7: Spalling & Exposed Rebar on Main Girder (A2, Rajshahi End)

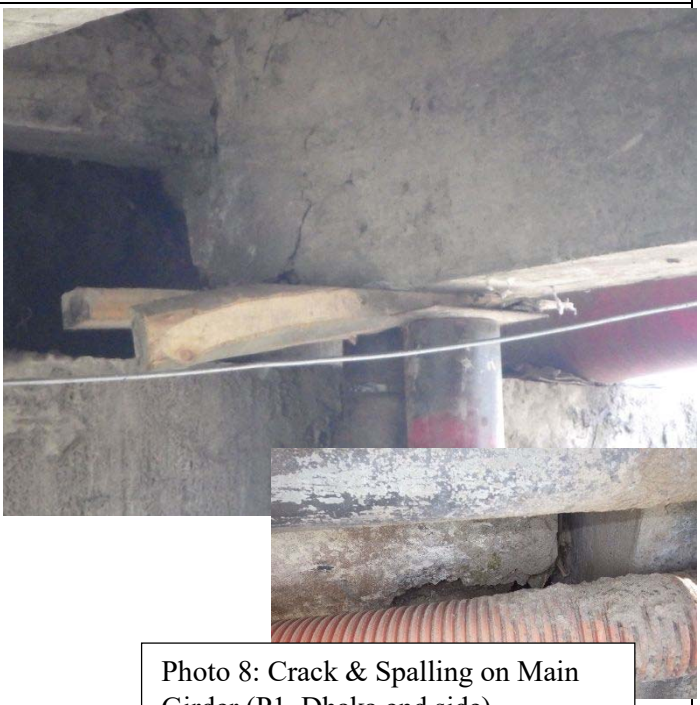


Photo 8: Crack & Spalling on Main Girder (P1, Dhaka end side)

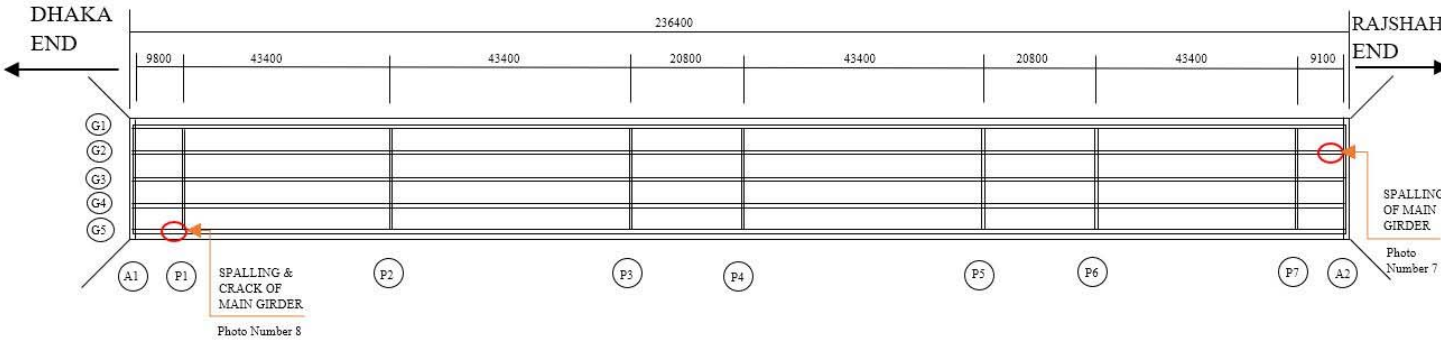
Photo 9: Underside of the Bridge (PC portion)

NALKA BRIDGE GENERAL VIEW

PLAN

1st & Last span is RC structure & rest of the spans are PC structure

Unit: Millimeter



Recommended Repair Methods

BMCDP Yasuo KOSAKA

1. Exposed Rebar Damage

   For the damaged Girder, close to the A2 (Photo 7), the usage of Repair Mortar with good bond ability and less shrinkage property is efficient, see our Rehabilitation manual, Appendix Plate 3-3、Hand applied mortar (B).

2. Crack & Spalling at Girder end

   For the Crack Repair of the Girder End (Photo 8), the Crack Filling with Epoxi resin is recommended. As the Alternative repair, Hand applied mortar after making U-formed cut can be taken, too.

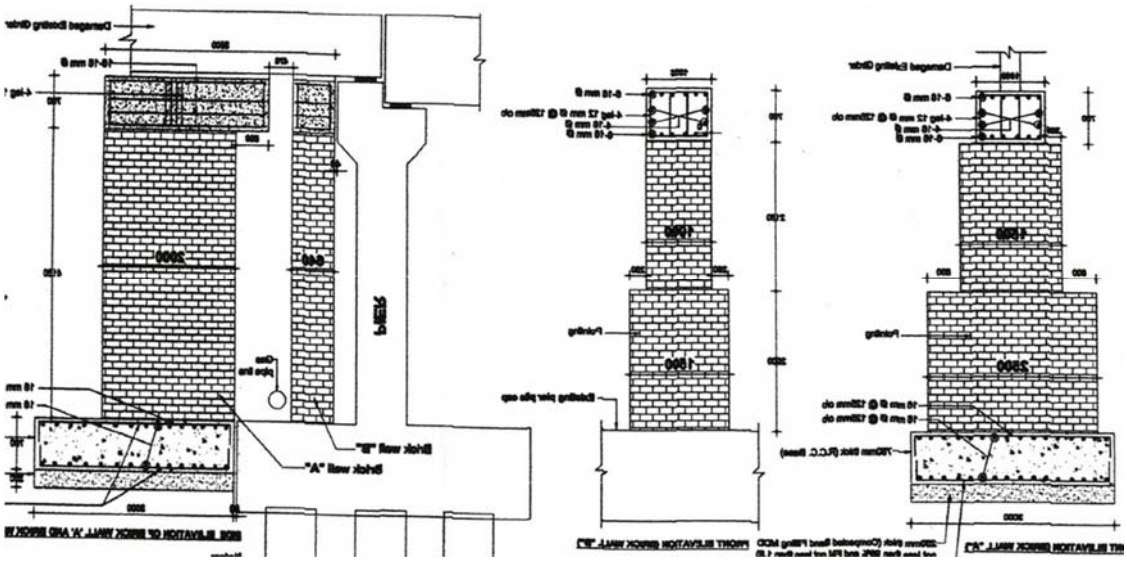
Photo 9 crack Filling

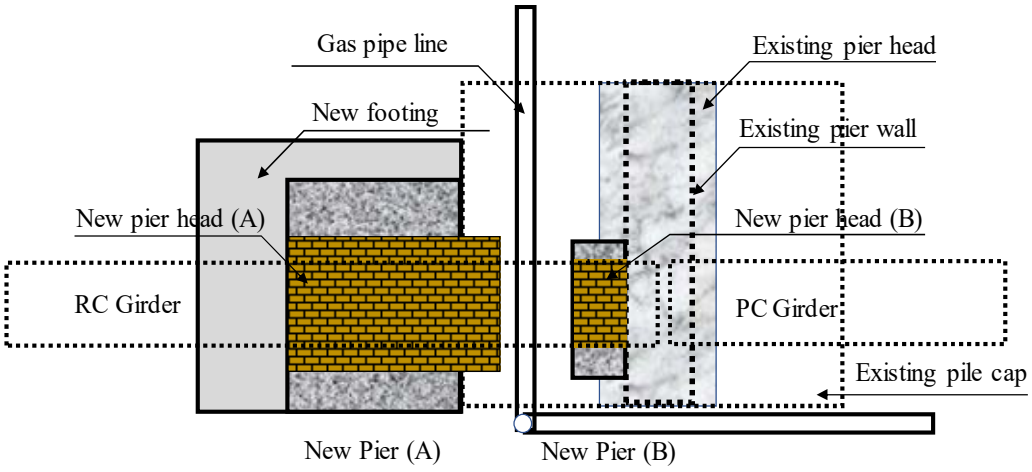
The reason of the crack is assumed, as temperature crack. Therefore, the annual crack inspection for all Girder ends of P1 & P7 (shorter Span sides) is advisable.

For the Spalling damage, the same Repair as Hand applied mortar (B) is useful.

The planned additional Support (by Division Office, see next page) is helpful for the Traffic Safety, but as the first step, the Crack repair is important. By the additional Support, the Gap to the Girder should set around 10-15 mm.

Supposed Additional Support by RHD





ANNEX 3: PDM (All versions of PDM)

Ver.0 15th February, 2015
Ver.1 30th August, 2015
Ver.2 28th January, 2016
Ver.3 5th March, 2017
Ver.4 5th March, 2017
Ver.5 3rd December, 2017
Ver.6 15th August, 2018

Project Design Matrix

Project Title: Bridge Management Capacity Development Project

Version 0

Implementing Agency: Organizations: Ministry of Communication, Roads and Highways Department (RHD)

Dated ●●,●●,2014

Target Group: Staff in RHD head office and zone offices

Period of Project: XX 2014 – XX 2016, 30 months

Project Site: RHD Head office **Model Site: XX district**

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal					
Bridge management under RHD is enhanced	1. Annual ratio of bridge inspection conducted by RHD is increased from XX% to XX% 2. Bridge maintenance cycle is conducted by RHD	• Record of bridge inspection • Input-output data of BMS			
Project Purpose					
Bridge maintenance capacity of RHD is improved	1. Bridge maintenance cycle is commenced by RHD 2. Necessary training based on the human resource development plan is conducted by Master Trainers (MTs)	• Record of bridge inspection • Input-output data of BMS • Report on training conducted by Master Trainers (MTs)	• Budgets for bridge maintenance are secured • Staff for bridge management is continuously allocated		
Outputs					
1. Bridge maintenance framework is developed	1-1. Documents of Bridge maintenance procedure and staff deployment are approved by XX 1-2. Bridge inspection based on the bridge maintenance cycle is commenced by RHD 1-3. Data management by utilization of BMS is commenced by RHD 1-4. Bridge maintenance plan (annual budget and work plans) in model area(s) is prepared	• Documents of Bridge maintenance procedure and staff deployment • Bridge maintenance plan (annual budget and work plans) in model area(s)			
2. Bridge inspection / diagnose manual and bridge rehabilitation / retrofitting manual are developed	2-1. Bridge inspection / diagnosis manual is approved by XX 2-2. Bridge rehabilitation / retrofitting manual is approved by XX	• Bridge inspection / diagnosis manual • Bridge rehabilitation / retrofitting manual			
3. Bridge management system is developed	3-1. Data accessability of BMS is improved 3-2. BMS manual is approved by XX	• Access log of BMS • BMS manual			
4. Necessary knowledge of bridge management is enhanced by RHD staff	4-1. XX bridge inspection MTs are trained 4-2. XX bridge rehabilitation MTs are trained 4-3. XX BMS administrators are trained 4-4. The human resource development plan is approved	• Report on training conducted by Experts • Human resource development plan			

Activities	Inputs		Important Assumption
	The Japanese Side	**The Bangladesh Side**	
1-1. Actual condition of bridge maintenance is reviewed 1-2. Problems / issues on bridge maintenance cycle are identified 1-3. Institutional framework of bridge maintenance is reviewed 1-4. Documents of bridge maintenance procedure and standard of staff deployment are prepared 2-1. Existing bridge maintenance manual is reviewed and issues/problems on the manual are analysed 2-2. Bridge inspection / diagnosis manual is updated 2-3. Bridge rehabilitation / retrofitting manual is prepared 2-4. Manuals for Bridge maintenance are explained to RHD staff by Master Trainers (MTs) 3-1. Existing BMMS is reviewed and analysed 3-2. Utilisation of BMS is examined together by RHD 3-3. Function of BMS is defined and developed 3-4. Data in existing BMMS is entered into BMS by RHD 3-5. BMS manual for administrators and users is prepared 3-6. BMS manual is explained to RHD staff by BMS administrators 4-1. On the job trainings (OJTs) on bridge inspection / diagnosis in model area(s) are conducted with bridge inspection / diagnosis manual 4-2. OJTs on prioritizing bridges to be repaired in model area(s) are conducted by utilization of BMS 4-3. OJTs on selection of bridge rehabilitation / retrofitting measures, cost estimation in model area(s) are conducted with Bridge rehabilitation / retrofitting manual 4-4. Advices on supervision of bridge rehabilitation / retrofitting works are given by Expert 4-5. Human resource development plan is prepared	1. Experts 1) Bridge Maintenance Plan 2) Bridge Inspection 3) Bridge Soundness Evaluation 4) Bridge rehabilitation / retrofitting 5) Bridge Management System 6) Cost Estimation (Bridge Maintenance) 7) Project Coordinator 2. Procurement of machinery and equipment 1) Computers for database with accesories 2) Concrete testing equipment ・Ground penetrating radar (RC Rader) ・Concrete core sampling apparatus ・Electric drill 3. Training in Japan 2 times 4. Expenses 1) Operational expenses for workshop and seminars 2) Other expenses needed for the Project implementation	1. Personnel 1) Project Director 2) Additional Project Director 3) Project Manager 4) Deputy Project Manager 5) Counterpart (C/P) of RHD 6) Other staffs 2. Facility and Equipment 1) Offices (inside RHD building) 3. Expenses for activities 1) Personal and travel expenses and daily allowances for C/P 2) Other necessary costs	・Bridge rehabilitation / retrofitting works for advisory activity (Activity 4-4) are implemented by RHD **Pre-Conditions** ・Skilled and appropriate engineers are allocated in RHD ・Policy priority on bridge maintenance is not drastically decreased **<Issues and countermesures>**

Project Design Matrix (Project Monitoring Sheet I)

Project Title: Bridge Management Capacity Development Project

Version 1

Implementing Agency: Organizations: Ministry of Communication, Roads and Highways Department (RHD)

Dated 30, August,2015

Target Group: Staff in RHD head office and zone offices

Period of Project: 10 July 2015 – 2 March 2018, 32 months

Project Site: RHD Head office **Model Site: Manikganj Division**

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal					
Bridge management under RHD is enhanced	1. Annual ratio of bridge inspection conducted by RHD is increased from XX% to XX% 2. Bridge maintenance cycle is conducted by RHD	・Record of bridge inspection ・Input-output data of BMS			
Project Purpose					
Bridge maintenance capacity of RHD is improved	1. Bridge maintenance cycle is commenced by RHD 2. Necessary training based on the institutional capacity development plan is conducted by Master Trainers (MT)	・Record of bridge inspection ・Input-output data of BMS ・Report on training conducted by Master Trainers (MT)	・Budgets for bridge maintenance are secured ・Staff for bridge management is continuously allocated		
Outputs					
1. Bridge maintenance framework is developed	1-1. Documents of Bridge maintenance procedure and staff deployment are approved by XX 1-2. Bridge inspection based on the bridge maintenance cycle is commenced by RHD 1-3. Data management by utilization of BMS is commenced by RHD 1-4. Bridge maintenance plan (annual budget and work plans) in model area(s) is prepared	・Documents of Bridge maintenance procedure and staff deployment ・Bridge maintenance plan (annual budget and work plans) in model area(s)			
2. Bridge inspection / evaluation manual and Bridge rehabilitation / strengthening manual are developed	2-1. Bridge inspection / evaluation manual is approved by XX 2-2. Bridge rehabilitation / strengthening manual is approved by XX	・Bridge inspection / evaluation manual ・Bridge rehabilitation / strengthening manual			
3. Bridge management system is developed	3-1. Data accessibility of BMS is improved 3-2. BMS manual is approved by XX	・Access log of BMS ・BMS manual			
4. Necessary knowledge of bridge management is enhanced by RHD staff	4-1. XX bridge inspection MT are trained 4-2. XX bridge rehabilitation MT are trained 4-3. XX BMS administrators are trained 4-4. Institutional capacity development plan is approved	・Training report ・Institutional capacity development plan			

Activities	Inputs		Important Assumption
	The Japanese Side	**The Bangladesh Side**	
1-1. Actual condition of bridge maintenance is reviewed 1-2. Problems / issues on bridge maintenance cycle are identified 1-3. Institutional framework of bridge maintenance is reviewed 1-4. Documents of bridge maintenance procedure and standard of staff deployment are prepared 2-1. Existing bridge maintenance manual is reviewed and issues/problems on the manual are analysed 2-2. Bridge inspection / evaluation manual is updated 2-2-1. Bridge inspection / evaluation manual (Inspection) is updated 2-2-2. Bridge inspection / evaluation manual (Evaluation) is prepared 2-3. Bridge rehabilitation / strengthening manual is prepared 2-3-1. Bridge rehabilitation / strengthening manual (Rehabilitation/strengthening measures) is prepared 2-3-2. Bridge rehabilitation / strengthening manual (Cost Estimate) is prepared 2-4. Manuals for Bridge maintenance are explained to RHD staff by Master Trainers (MT) 3-1. Existing BMMS is reviewed and analysed 3-2. Utilisation of BMS is examined together by RHD 3-3. Function of BMS is defined and developed 3-4. Data in existing BMMS is entered into BMS by RHD 3-5. BMS manual for administrators and users is prepared 3-6. BMS manual is explained to RHD staff by BMS administrators 4-1. On the job trainings (OJTs) on bridge inspection / evaluation in model area(s) are conducted with Bridge inspection / evaluation manual 4-2. OJTs on prioritizing bridges to be repaired in model area(s) are conducted by utilization of BMS 4-3. OJTs on selection of bridge rehabilitation / strengthening measures, cost estimation in model area(s) are conducted with Bridge rehabilitation / strengthening manual 4-4. Advices on supervision of bridge rehabilitation / strengthening works are given by Expert 4-5. Institutional capacity development plan is prepared	1. Experts 1) Team Leader/Bridge Maintenance Plan 2) Bridge Inspection 3) Bridge Evaluation 4) Bridge Maintenance Plan (2) 5) Detailed Survey 6) Bridge Rehabilitation・Strengthening/Bridge Evaluation (2) 7) Cost Estimate 8) Bridge Management System 9) Asset Management 10) Project Monitoring 11) Coordinator/Bridge Maintenance Plan (Assistance) 2. Procurement of machinery and equipment 1) Computers for database with accessories 2) Concrete testing equipment ・Ground penetrating radar (RC Rader) ・Concrete core sampling apparatus ・Electric drill 3. Training in Japan 2 times 4. Expenses 1) Operational expenses for workshop and seminars 2) Other expenses needed for the Project implementation	1. Personnel 1) Project Director 2) Additional Project Director 3) Project Manager 4) Deputy Project Manager 5) Counterpart (C/P) of RHD 6) Other relevant units 2. Facility and Equipment 1) Offices (inside RHD building) 3. Expenses for activities 1) Personal and travel expenses and daily allowances for C/P 2) Other necessary costs	・Bridge rehabilitation / strengthening works for advisory activity (Activity 4-4) are implemented by RHD

Pre-Conditions
・Skilled and appropriate engineers are allocated in RHD ・Policy priority on bridge maintenance is not drastically decreased

<Issues and countermeasures>

Project Design Matrix (Project Monitoring Sheet I)

Project Title: Bridge Management Capacity Development Project

Version 2

Dated 28th January, 2016

Implementing Agency: Organizations: Ministry of Communication, Roads and Highways Department (RHD)

Target Group: Staff in RHD head office and zone offices

Period of Project: 10 July 2015 – 2 March 2018, 32 months

Project Site: RHD Head office **Model Site: Manikganj Division**

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal					
Bridge management under RHD is enhanced	1. Annual ratio of bridge inspection conducted by RHD is increased from XX% to XX% 2. Bridge maintenance cycle is conducted by RHD	・Record of bridge inspection ・Input-output data of BMS			
Project Purpose					
Bridge maintenance capacity of RHD is improved	1. Bridge maintenance cycle is commenced by RHD 2. Necessary training based on the institutional capacity development plan is conducted by Master Trainers (MT)	・Record of bridge inspection ・Input-output data of BMS ・Report on training conducted by Master Trainers (MT)	・Budgets for bridge maintenance are secured ・Staff for bridge management is continuously allocated		
Outputs					
1. Bridge maintenance framework is developed	1-1. Documents of Bridge maintenance procedure and staff deployment are approved by XX 1-2. Bridge inspection based on the bridge maintenance cycle is commenced by RHD 1-3. Data management by utilization of BMS is commenced by RHD 1-4. Bridge maintenance plan (annual budget and work plans) in model area(s) is prepared	・Documents of Bridge maintenance procedure and staff deployment ・Bridge maintenance plan (annual budget and work plans) in model area(s)			
2. Bridge inspection / evaluation manual and Bridge rehabilitation / strengthening manual are developed	2-1. Bridge inspection / evaluation manual is approved by XX 2-2. Bridge rehabilitation / strengthening manual is approved by XX	・Bridge inspection / evaluation manual ・Bridge rehabilitation / strengthening manual			
3. Bridge management system is developed	3-1. Data accessibility of BMS is improved 3-2. BMS manual is approved by XX	・Access log of BMS ・BMS manual			
4. Necessary knowledge of bridge management is enhanced by RHD staff	4-1. XX bridge inspection MT are trained 4-2. XX bridge rehabilitation MT are trained 4-3. XX BMS administrators are trained 4-4. Institutional capacity development plan is approved	・Training report ・Institutional capacity development plan			

Activities	Inputs		Important Assumption
	The Japanese Side	**The Bangladesh Side**	
1-1. Actual condition of bridge maintenance is reviewed 1-2. Problems / issues on bridge maintenance cycle are identified 1-3. Institutional framework of bridge maintenance is reviewed 1-4. Documents of bridge maintenance procedure and standard of staff deployment are prepared 2-1. Existing bridge maintenance manual is reviewed and issues/problems on the manual are analysed 2-2. Bridge inspection / evaluation manual is updated 2-2-1. Bridge inspection / evaluation manual (Inspection) is updated 2-2-2. Bridge inspection / evaluation manual (Evaluation) is prepared 2-3. Bridge rehabilitation / strengthening manual is prepared 2-3-1. Bridge rehabilitation / strengthening manual (Rehabilitation/strengthening measures) is prepared 2-3-2. Bridge rehabilitation / strengthening manual (Cost Estimate) is prepared 2-4. Manuals for Bridge maintenance are explained to RHD staff by Master Trainers (MT) 3-1. Existing BMMS is reviewed and analysed 3-2. Utilisation of BMS is examined together by RHD 3-3. Function of BMS is defined and developed 3-4. Data in existing BMMS is entered into BMS by RHD 3-5. BMS manual for administrators and users is prepared 3-6. BMS manual is explained to RHD staff by BMS administrators 4-1. On the job trainings (OJTs) on bridge inspection / evaluation in model area(s) are conducted with Bridge inspection / evaluation manual 4-2. OJTs on prioritizing bridges to be repaired in model area(s) are conducted by utilization of BMS 4-3. OJTs on selection of bridge rehabilitation / strengthening measures, cost estimation in model area(s) are conducted with Bridge rehabilitation / strengthening manual 4-4. Advices on supervision of bridge rehabilitation / strengthening works are given by Expert 4-5. Institutional capacity development plan is prepared	1. Experts 1) Team Leader/Bridge Maintenance Plan 2) Bridge Inspection 3) Bridge Evaluation 4) Bridge Maintenance Plan (2) 5) Detailed Survey 6) Bridge Rehabilitation・Strengthening/Bridge Evaluation (2) 7) Cost Estimate 8) Bridge Management System 9) Asset Management 10) Project Monitoring 11) Coordinator/Bridge Maintenance Plan (Assistance) 2. Procurement of machinery and equipment 1) Computers for database with accessories 2) Concrete testing equipment ・Ground penetrating radar (RC Rader) ・Concrete core sampling apparatus ・Electric drill 3. Training in Japan 2 times 4. Expenses 1) Operational expenses for workshop and seminars 2) Other expenses needed for the Project implementation	1. Personnel 1) Project Director 2) Additional Project Director 3) Project Manager 4) Deputy Project Manager 5) Counterpart (C/P) of RHD 6) Other relevant units 2. Facility and Equipment 1) Offices (inside RHD building) 3. Expenses for activities 1) Personal and travel expenses and daily allowances for C/P 2) Other necessary costs	・Bridge rehabilitation / strengthening works for advisory activity (Activity 4-4) are implemented by RHD

Pre-Conditions
・Skilled and appropriate engineers are allocated in RHD ・Policy priority on bridge maintenance is not drastically decreased

<Issues and countermeasures>

Project Design Matrix (Project Monitoring Sheet I)

Project Title: Bridge Management Capacity Development Project

Version 3

Dated 5th March, 2017

Implementing Agency: Organizations: Ministry of Road Transport and Bridges, Roads and Highways Department (RHD)

Target Group: Staff in RHD head office and zone offices

Period of Project: 10 July 2015 – 2 March 2018, 32 months

Project Site: RHD Head office **Model Site: Manikganj Division**

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal					
Bridge management under RHD is enhanced	1. Annual ratio of bridge inspection conducted by RHD is increased from XX% to XX% 2. Bridge maintenance cycle is conducted by RHD	・Record of bridge inspection ・Input-output data of BMS			
Project Purpose					
Bridge maintenance capacity of RHD is improved	1. Bridge maintenance cycle is commenced by RHD 2. Necessary training based on the institutional capacity development plan is conducted by Master Trainers (MT)	・Record of bridge inspection ・Input-output data of BMS ・Report on training conducted by Master Trainers (MT)	・Budgets for bridge maintenance are secured ・Staff for bridge management is continuously allocated	Each indicator will be measured during the 5th JCC (a couple of months before the project completion).	
Outputs					
1. Bridge maintenance framework is developed	1-1. Documents of Bridge maintenance procedure and staff deployment are approved by RHD 1-2. Bridge inspection based on the bridge maintenance cycle is commenced by RHD 1-3. Data management by utilization of BMS is commenced by RHD 1-4. Bridge maintenance plan (annual budget and work plans) in model area(s) is prepared	・Documents of Bridge maintenance procedure and staff deployment ・Bridge maintenance plan (annual budget and work plans) in model area(s)		Each indicator will be measured during the 4th JCC.	
2. Bridge inspection / evaluation manual and Bridge rehabilitation / strengthening manual are developed	2-1. Bridge inspection / evaluation manual is approved by RHD 2-2. Bridge rehabilitation / strengthening manual is approved by RHD	・Bridge inspection / evaluation manual ・Bridge rehabilitation / strengthening manual			
3. Bridge management system is developed	3-1. Data accessibility of BMS is improved 3-2. BMS manual is approved by RHD	・Access log of BMS ・BMS manual			
4. Necessary knowledge of bridge management is enhanced by RHD staff	4-1. 75 bridge inspection MT are trained 4-2. 75 bridge rehabilitation MT are trained 4-3. 75 BMS administrators are trained 4-4. Institutional capacity development plan is approved	・Training report ・Institutional capacity development plan			

Activities	Inputs		Important Assumption
	The Japanese Side	**The Bangladesh Side**	
1-1. Actual condition of bridge maintenance is reviewed 1-2. Problems / issues on bridge maintenance cycle are identified 1-3. Institutional framework of bridge maintenance is reviewed 1-4. Documents of bridge maintenance procedure and standard of staff deployment are prepared 2-1. Existing bridge maintenance manual is reviewed and issues/problems on the manual are analysed 2-2. Bridge inspection / evaluation manual is updated 2-2-1. Bridge inspection / evaluation manual (Inspection) is updated 2-2-2. Bridge inspection / evaluation manual (Evaluation) is prepared 2-3. Bridge rehabilitation / strengthening manual is prepared 2-3-1. Bridge rehabilitation / strengthening manual (Rehabilitation/strengthening measures) is prepared 2-3-2. Bridge rehabilitation / strengthening manual (Cost Estimate) is prepared 2-4. Manuals for Bridge maintenance are explained to RHD staff by Master Trainers (MT) 3-1. Existing BMMS is reviewed and analysed 3-2. Utilisation of BMS is examined together by RHD 3-3. Function of BMS is defined and developed 3-4. Data in existing BMMS is entered into BMS by RHD 3-5. BMS manual for administrators and users is prepared 3-6. BMS manual is explained to RHD staff by BMS administrators 4-1. On the job trainings (OJTs) on bridge inspection / evaluation in model area(s) are conducted with Bridge inspection / evaluation manual 4-2. OJTs on prioritizing bridges to be repaired in model area(s) are conducted by utilization of BMS 4-3. OJTs on selection of bridge rehabilitation / strengthening measures, cost estimation in model area(s) are conducted with Bridge rehabilitation / strengthening manual 4-4. Advices on supervision of bridge rehabilitation / strengthening works are given by Expert 4-5. Institutional capacity development plan is prepared	1. Experts 1) Team Leader/Bridge Maintenance Plan 2) Bridge Inspection 3) Bridge Evaluation 4) Bridge Maintenance Plan (2) 5) Detailed Survey 6) Bridge Rehabilitation・Strengthening/Bridge Evaluation (2) 7) Cost Estimate 8) Bridge Management System 9) Asset Management 10) Project Monitoring 11) Coordinator/Bridge Maintenance Plan (Assistance) 2. Procurement of machinery and equipment 1) Computers for database with accessories 2) Concrete testing equipment ・Ground penetrating radar (RC Rader) ・Concrete core sampling apparatus ・Electric drill 3. Training in Japan 2 times 4. Expenses 1) Operational expenses for workshop and seminars 2) Other expenses needed for the Project implementation	1. Personnel 1) Project Director 2) Additional Project Director 3) Project Manager 4) Deputy Project Manager 5) Counterpart (C/P) of RHD 6) Other relevant units 2. Facility and Equipment 1) Offices (inside RHD building) 3. Expenses for activities 1) Personal and travel expenses and daily allowances for C/P 2) Other necessary costs	・Bridge rehabilitation / strengthening works for advisory activity (Activity 4-4) are implemented by RHD **Pre-Conditions** ・Skilled and appropriate engineers are allocated in RHD ・Policy priority on bridge maintenance is not drastically decreased **<Issues and countermeasures>**

Project Design Matrix (Project Monitoring Sheet I)

Project Title: Bridge Management Capacity Development Project

Version 4

Dated 5th March, 2017

Implementing Agency: Organizations: Ministry of Road Transport and Bridges, Roads and Highways Department (RHD)

Target Group: Staff in RHD head office and zone offices

Period of Project: 10 July 2015 – 2 March 2018, 32 months

Project Site: RHD Head office **Model Site: Manikganj Division**

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal					
Bridge management under RHD is enhanced	1. Annual ratio of bridge inspection conducted by RHD is increased to 50% 2. Bridge maintenance cycle is conducted by RHD	・Record of bridge inspection ・Input-output data of BMS		XX will be replaced with numbers during the 4th JCC.	
Project Purpose					
Bridge maintenance capacity of RHD is improved	1. Bridge maintenance cycle is commenced by RHD 2. Master Trainers (MTs) are trained. 3. Necessary training based on the institutional capacity development plan is conducted by Master Trainers (MT)	・Record of bridge inspection ・Input-output data of BMS ・Report on training conducted by Master Trainers (MT)	・Budgets for bridge maintenance are secured ・Staff for bridge management is continuously allocated	Each indicator will be measured during the 5th JCC (a couple of months before the project completion).	
Outputs					
1. Bridge maintenance framework is developed	1-1. Documents of Bridge maintenance procedure and staff deployment are approved by RHD 1-2. Bridge inspection based on the bridge maintenance cycle is commenced by RHD 1-3. Data management by utilization of BMS is commenced by RHD 1-4. Bridge maintenance plan (annual budget and work plans) in model area(s) is prepared	・Documents of Bridge maintenance procedure and staff deployment ・Bridge maintenance plan (annual budget and work plans) in model area(s)		Each indicator will be measured during the 4th JCC.	
2. Bridge inspection / evaluation manual and Bridge rehabilitation / strengthening manual are developed	2-1. Bridge inspection / evaluation manual is approved by RHD 2-2. Bridge rehabilitation / strengthening manual is approved by RHD	・Bridge inspection / evaluation manual ・Bridge rehabilitation / strengthening manual			
3. Bridge management system is developed	3-1. Data accessibility of BMS is improved 3-2. BMS manual is approved by RHD	・Access log of BMS ・BMS manual			
4. Necessary knowledge of bridge management is enhanced by RHD staff	4-1. 75 bridge inspection MT are trained 4-2. 75 bridge rehabilitation MT are trained 4-3. 75 BMS administrators are trained 4-4. Institutional capacity development plan is approved	・Training report ・Institutional capacity development plan			

Activities	Inputs		Important Assumption
	The Japanese Side	**The Bangladesh Side**	
1-1. Actual condition of bridge maintenance is reviewed 1-2. Problems / issues on bridge maintenance cycle are identified 1-3. Institutional framework of bridge maintenance is reviewed 1-4. Documents of bridge maintenance procedure and standard of staff deployment are prepared 2-1. Existing bridge maintenance manual is reviewed and issues/problems on the manual are analysed 2-2. Bridge inspection / evaluation manual is updated 2-2-1. Bridge inspection / evaluation manual (Inspection) is updated 2-2-2. Bridge inspection / evaluation manual (Evaluation) is prepared 2-3. Bridge rehabilitation / strengthening manual is prepared 2-3-1. Bridge rehabilitation / strengthening manual (Rehabilitation/strengthening measures) is prepared 2-3-2. Bridge rehabilitation / strengthening manual (Cost Estimate) is prepared 2-4. Manuals for Bridge maintenance are explained to RHD staff by Master Trainers (MT) 3-1. Existing BMMS is reviewed and analysed 3-2. Utilisation of BMS is examined together by RHD 3-3. Function of BMS is defined and developed 3-4. Data in existing BMMS is entered into BMS by RHD 3-5. BMS manual for administrators and users is prepared 3-6. BMS manual is explained to RHD staff by BMS administrators 4-1. On the job trainings (OJTs) on bridge inspection / evaluation in model area(s) are conducted with Bridge inspection / evaluation manual 4-2. OJTs on prioritizing bridges to be repaired in model area(s) are conducted by utilization of BMS 4-3. OJTs on selection of bridge rehabilitation / strengthening measures, cost estimation in model area(s) are conducted with Bridge rehabilitation / strengthening manual 4-4. Advices on supervision of bridge rehabilitation / strengthening works are given by Expert 4-5. Institutional capacity development plan is prepared	1. Experts 1) Team Leader/Bridge Maintenance Plan 2) Bridge Inspection 3) Bridge Evaluation 4) Bridge Maintenance Plan (2) 5) Detailed Survey 6) Bridge Rehabilitation・Strengthening/Bridge Evaluation (2) 7) Cost Estimate 8) Bridge Management System 9) Asset Management 10) Project Monitoring 11) Coordinator/Bridge Maintenance Plan (Assistance) 2. Procurement of machinery and equipment 1) Computers for database with accessories 2) Concrete testing equipment ・Ground penetrating radar (RC Rader) ・Concrete core sampling apparatus ・Electric drill 3. Training in Japan 2 times 4. Expenses 1) Operational expenses for workshop and seminars 2) Other expenses needed for the Project implementation	1. Personnel 1) Project Director 2) Additional Project Director 3) Project Manager 4) Deputy Project Manager 5) Counterpart (C/P) of RHD 6) Other relevant units 2. Facility and Equipment 1) Offices (inside RHD building) 2) Engineering Equipment/Inspection Equipment 3. Expenses for activities 1) Personal and travel expenses and daily allowances for C/P 2) Other necessary costs	・Bridge rehabilitation / strengthening works for advisory activity (Activity 4-4) are implemented by RHD

Pre-Conditions

・Skilled and appropriate engineers are allocated in RHD
・Policy priority on bridge maintenance is not drastically decreased

<Issues and countermeasures>

Project Design Matrix (Project Monitoring Sheet I)

Project Title: Bridge Management Capacity Development Project

Version 5
Dated 3rd December, 2017

Implementing Agency: Organizations: Ministry of Road Transport and Bridges, Roads and Highways Department (RHD)

Target Group: Staff in RHD head office and zone offices

Period of Project: 10 July 2015 – 2 November 2018, 40 months

Project Site: RHD Head office **Model Site: Manikganj Division**

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal					
Bridge management under RHD is enhanced	1. Annual ratio of bridge inspection conducted by RHD is increased to 50% 2. Bridge maintenance cycle is conducted by RHD	・Record of bridge inspection ・Input-output data of BMS		The indicators of the Overall Goal will be measured during the ex-post evaluation.	
Project Purpose					
Bridge maintenance capacity of RHD is improved	1. Bridge maintenance cycle is commenced by RHD 2. Master Trainers (MTs) are trained. 3. Necessary training based on the institutional capacity development plan is conducted by Master Trainers (MT)	・Record of bridge inspection ・Input-output data of BMS ・Report on training conducted by Master Trainers (MT)	・Budgets for bridge maintenance are secured ・Staff for bridge management is continuously allocated	Each indicator will be measured during the 5th JCC (a couple of months before the project completion).	
Outputs					
1. Bridge maintenance framework is developed	1-1. Documents of Bridge maintenance procedure and staff deployment are approved by RHD 1-2. Bridge inspection based on the bridge maintenance cycle is commenced by RHD 1-3. Data management by utilization of BMS is commenced by RHD 1-4. Bridge maintenance plan (annual budget and work plans) in model area(s) is prepared	・Documents of Bridge maintenance procedure and staff deployment ・Bridge maintenance plan (annual budget and work plans) in model area(s)		Results of achievements measured of each indicator are described in the Monitoring Sheet version 5 and shared during the 4th JCC.	
2. Bridge inspection / evaluation manual and Bridge rehabilitation / strengthening manual are developed	2-1. Bridge inspection / evaluation manual is approved by RHD 2-2. Bridge rehabilitation / strengthening manual is approved by RHD	・Bridge inspection / evaluation manual ・Bridge rehabilitation / strengthening manual			
3. Bridge management system is developed	3-1. Data accessibility of BMS is improved 3-2. BMS manual is approved by RHD	・Access log of BMS ・BMS manual			
4. Necessary knowledge of bridge management is enhanced by RHD staff	4-1. 75 bridge inspection MT are trained 4-2. 75 bridge rehabilitation MT are trained 4-3. 75 BMS administrators are trained 4-4. Institutional capacity development plan is approved	・Training report ・Institutional capacity development plan			

Activities	Inputs		Important Assumption
	The Japanese Side	**The Bangladesh Side**	
1-1. Actual condition of bridge maintenance is reviewed 1-2. Problems / issues on bridge maintenance cycle are identified 1-3. Institutional framework of bridge maintenance is reviewed 1-4. Documents of bridge maintenance procedure and standard of staff deployment are prepared 2-1. Existing bridge maintenance manual is reviewed and issues/problems on the manual are analysed 2-2. Bridge inspection / evaluation manual is updated 2-2-1. Bridge inspection / evaluation manual (Inspection) is updated 2-2-2. Bridge inspection / evaluation manual (Evaluation) is prepared 2-3. Bridge rehabilitation / strengthening manual is prepared 2-3-1. Bridge rehabilitation / strengthening manual (Rehabilitation/strengthening measures) is prepared 2-3-2. Bridge rehabilitation / strengthening manual (Cost Estimate) is prepared 2-4. Manuals for Bridge maintenance are explained to RHD staff by Master Trainers (MT) 3-1. Existing BMMS is reviewed and analysed 3-2. Utilisation of BMS is examined together by RHD 3-3. Function of BMS is defined and developed 3-4. Data in existing BMMS is entered into BMS by RHD 3-5. BMS manual for administrators and users is prepared 3-6. BMS manual is explained to RHD staff by BMS administrators 4-1. On the job trainings (OJTs) on bridge inspection / evaluation in model area(s) are conducted with Bridge inspection / evaluation manual 4-2. OJTs on prioritizing bridges to be repaired in model area(s) are conducted by utilization of BMS 4-3. OJTs on selection of bridge rehabilitation / strengthening measures, cost estimation in model area(s) are conducted with Bridge rehabilitation / strengthening manual 4-4. Advices on supervision of bridge rehabilitation / strengthening works are given by Expert 4-5. Institutional capacity development plan is prepared	1. Experts 1) Team Leader/Bridge Maintenance Plan 2) Bridge Inspection 3) Bridge Evaluation 4) Bridge Maintenance Plan (2) 5) Detailed Survey 6) Bridge Rehabilitation・Strengthening/Bridge Evaluation (2) 7) Cost Estimate 8) Bridge Management System 9) Asset Management 10) Project Monitoring 11) Coordinator/Bridge Maintenance Plan (Assistance) 2. Procurement of machinery and equipment 1) Computers for database with accessories 2) Concrete testing equipment ・Ground penetrating radar (RC Rader) ・Concrete core sampling apparatus ・Electric drill 3. Training in Japan 2 times 4. Expenses 1) Operational expenses for workshop and seminars 2) Other expenses needed for the Project implementation	1. Personnel 1) Project Director 2) Additional Project Director 3) Project Manager 4) Deputy Project Manager 5) Counterpart (C/P) of RHD 6) Other relevant units 2. Facility and Equipment 1) Offices (inside RHD building) 2) Engineering Equipment/Inspection Equipment 3. Expenses for activities 1) Personal and travel expenses and daily allowances for C/P 2) Other necessary costs	・Bridge rehabilitation / strengthening works for advisory activity (Activity 4-4) are implemented by RHD

Pre-Conditions

・Skilled and appropriate engineers are allocated in RHD
・Policy priority on bridge maintenance is not drastically decreased

<Issues and countermeasures>

Project Design Matrix (Project Monitoring Sheet I)

Project Title: Bridge Management Capacity Development Project

Version 6
Dated 15th August, 2018

Implementing Agency: Organizations: Ministry of Road Transport and Bridges, Roads and Highways Department (RHD)

Target Group: Staff in RHD head office and zone offices

Period of Project: 10 July 2015 – 2 September 2018, 38 months

Project Site: RHD Head office **Model Site: Manikganj Division**

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal					
Bridge management under RHD is enhanced	1. Annual ratio of bridge inspection conducted by RHD is increased to 50% 2. Bridge maintenance cycle is conducted by RHD	・Record of bridge inspection ・Input-output data of BMS		The indicators of the Overall Goal will be measured during the ex-post evaluation.	
Project Purpose					
Bridge maintenance capacity of RHD is improved	1. Bridge maintenance cycle is commenced by RHD 2. Master Trainers (MTs) are trained. 3. Necessary training based on the institutional capacity development plan is conducted by Master Trainers (MT)	・Record of bridge inspection ・Input-output data of BMS ・Report on training conducted by Master Trainers (MT)	・Budgets for bridge maintenance are secured ・Staff for bridge management is continuously allocated	Each indicator will be measured during the 5th JCC (a couple of months before the project completion).	
Outputs					
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<Issues and countermeasures>